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August 18, 1934

ELECTRICAL WORLD

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Simple Off-Peak Rate Bids for Full-Use Homes

By it Middle West Utilities is getting idle ranges working again and speeds water heating

Penstock Maintenance and Protection Costs Analyzed

Hydro company in Pacific Northwest uses high quality coatings to protect submerged steel

Enamel Baking by Induction Developing Rapidly

Chrysler plant obtains greatly improved operations with new plan for baking wheel enamel

Standardization and Profits Aided by Preferred Numbers

Electrical manufacturer finds orderliness and economy to result from better planned equipment sizes

A New Voltage Regulator

Transformer-type construction developed to yield low losses and impedance values

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ELECTRICAL WORLD

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August 18, 1934

L. W. W. MORROW, *Editor*

Management Field—No Thoroughfare

A firm refusal to trespass on the field of management in dealing with various moot issues in the recent Boston Edison rate case illuminates the Massachusetts commission's 30-page decision in this notable proceeding. This attitude of the commission is at times tacit and again definitely set forth. Extended consideration of the company's contracts for the supply of coal to its generating plants in Boston and North Weymouth, for underground and overhead line construction by concerns long employed for this purpose, and for primary power supply from the New England Power Association system led to the conclusion that nothing improvident appears in these transactions. They were recognized as managerial acts *per se*. The company's opponents harshly attacked these and many other practices of the utility, but at every point the commission seems to have been determined to confine itself to regulation, avoiding temptation to managerial excursions with respect to the laying down of operating policies. The regulation of rates and adjudication of such matters as depreciation allowances and property included in rate bases of course modify managerial decisions in this and many other cases, but only in the exercise of that quasi-judicial ruling which lies at the core of modern commission practice.

To objectors that the company does not advertise for competitive bids for coal and line construction the board succinctly states that there is no law that requires a public utility to make its contracts through competition and that no convincing evidence was submitted in the case to warrant the conclusion that the arrangement is either unreasonable or improvident. The prudence of a managerial decision, the commission states, must be determined in the light of the conditions existing at the time the contract was made, not later. To interfere with the company's discretion in establishing competitive rates unless so low as to throw a burden upon higher price customers is outside the commission's declared intention. The border line in official salary reductions with respect to impairment of efficiency and the design of rate structures were both admitted to be topics of primary managerial concern. Sweeping though the Boston Edison finding may be in certain respects, its delineation of the zone between management and regulation, even by implication, is a much-needed note in the present medley of cries for more and more government in every phase of modern business.

Coal Industry Aroused

Sometimes it takes a selfish point of view to get an industry to investigate new policies or movements. At last the coal industry is awake to the effect of the billion-dollar hydro projects of the government and has studied these from the point of view of its own interests and those of the public. The conclusion reached is that this program is "social folly and economic waste."

The National Coal Association says that "the coal industry opposes the grandiose program and ruinous policy of the federal water-power development because its consummation is calculated to destroy the market for millions of tons of coal; to put hundreds of thousands of men out of employment permanently; to further impair railroad revenues permanently; to duplicate, and in many instances to destroy, existing facilities for the production and distribution of electricity." Also, it will "inflict incalculable injury upon both capital and labor in public utilities, in mines, in railroads

and upon those engaged in the distribution of coal, gas, lumber, ice and sundry lines, and will lay further burdens, both unwarranted and unnecessary, upon the American taxpayer by adding a billion dollars or more to the public debt."

The association adds up present appropriations and official estimates and commitments to arrive at a staggering total of $904,000,000 and gives data to show the extraordinary economic fallacy of adding productive capacity where an excess already exists. So serious is the situation that litigation has been started and will be continued to the bitter end. If a few other industries would take the trouble to investigate the subject there would soon be an end to government "yardsticks" which measure nothing but economic waste.

An Attitude Brings Results

Since the first of the year the electrical industry has adopted the constructive attitude of the automotive industry. It has recovered from its fear and inertia in large measure and has reached the sensible conclusion that it might as well go to work and bring about a more prosperous condition through its own action. Its motto has grown to be "forget the government and go after business."

And results are encouraging. Manufacturers and utilities record very favorable advances in business levels. An aggressive drive on domestic sales in the lower income classes, where recovery spending has been prevalent, will bring about one of the largest volumes of appliance sales in the history of the industry. The Better Light-Better Sight campaign produced good results and will be continued. Power and commercial sales have increased considerably. Loads are back to boom period levels. The industry has gone after its markets as the road to prosperity.

This is a policy of recovery that will work and that will put the government out of business. It is the only hope to avoid inflation, greater government participation in business and a larger burden of taxation. The electrical industry is to be commended for adopting this policy of aggression and self-help, especially as it has been the target for attacks by the government. Possibly other industries will also learn that their business salvation lies chiefly in their own hands and not in policies and actions formulated in Washington.

Current Research Is Active

In spite of the times, or perhaps because of them, research goes on apace. One might suppose that in such times as these research would be most active in university, government, and other laboratories not so immediately susceptible to curtailment during industrial depression. Although recent engineering meetings may seem to indicate, for the moment at least, that industrial research is definitely on the advance, by looking a little further it is easy to see that university research is equally active.

Never have the journals reporting the results of research in the field of the physical sciences, both pure and applied, had wider and more varied tables of contents. The American Physical Society has only recently found it necessary to enlarge its publication facilities so that the American Institute of Physics now publishes three separate journals which are of definite interest to electrical engineers, two of them devoted particularly to the applied field. A review of all papers presented to the A.I.E.E. in the past few years indicates that more than 50 per cent of them report the results of experimental research. Of these, as is natural, the more basic type of studies emanate from the university laboratories and those presenting the results of the application of new principles come from the ingenious staffs of manufacturers and utilities.

While the picture is not so clear as regards conditions abroad, there are undoubtedly certain countries in which research is still very active. England has always preferred the basic scientific to the applied field and has recently made new important contributions to electrical theory. Since the World War neither France nor Italy has been as productive as in earlier years. On the other hand, the well-known high level of scientific excellence is still evident in a goodly volume of papers from Germany. Of particular interest is a constant stream of contributions from Russia. Within both these groups the field of dielectrics and insulation is a favorite, and the sources are almost invariably university laboratories. It seems safe to conclude that here in the United States research of all types is more active than elsewhere, and from the quality and volume of it there is large promise that industry, when it is able to take hold of it, will find ample material for rapidly expanding progress.

Simple Off-Peak Rate Bids for Full-Use Homes

By It Middle West Utilities Company Is Getting Idle Ranges Working Again and Making One-Cent Water Heating Load Possible and Profitable

By EDWIN VENNARD

Head of Rate Department, Middle West Utilities Company, Chicago

IN PERIODS of declining revenue the stability of residential service attracts attention, and the relatively undeveloped possibilities in this field have been made the subject of recent plans by Middle West Utilities Company for further increasing the use of electric service in the home.

During the year 1933 the residential customers of the Middle West System used an average of only 475 kw.-hr. and constant demands were being made for rate reductions. Present earnings would not justify rate reductions. Adjustments downward could only be made as a means of increasing the use of service so as to increase net revenue. The situation seemed to be a deadlock between the company's proposal:

"Use more electricity and we can reduce the rates," and the customer's reply:

"Reduce the rates and we will use more electricity."

This was about the way matters stood when D. C. Green entered upon his duties as president of Middle West Utilities Company. After a general survey of rates, costs and possible markets, Mr. Green said:

> **"Our greatest opportunity to build up a stable revenue is in the broad field of residential service, and as a foundation upon which to build we must have a rate that will allow full use of electricity for all domestic purposes and at the same time balance the budgets of both the family and the utility company.**

"We already have rates that are fair and equitable for the family that wants to use only a small amount of electricity. Now let's design a rate for the family that wants to make full use of electricity—for cooking, refrigeration and water heating, as well as lighting and small household appliances.

> **"It will take a rate close to 1 cent a kilowatt-hour to make water heating practicable and most companies can afford to offer such a rate to homes equipped for cooking service if the water heater is controlled so as not to require added capacity.**

"The rate should provide a sufficiently high minimum charge to protect the company, but for that minimum the customer will be allowed a specified number of kilowatt-hours. Low energy steps in the rate, scaling down to 1 cent a kilowatt-hour, may then be provided. The 1-cent rate must be limited to the controlled water heater which will require a second meter. While the 1-cent feature will have to be set out as a separate item, it can be included in the same schedule with other service so as to show its true relation to full residence use. The rate may have a minimum bill of $2.50, for which the customer will be allowed, for instance, 30 or 40 kw.-hr. The uncontrolled service may then provide for energy steps of 4 cents for the next 100 kw.-hr. and 2 cents for all additional use. In the same schedule, but designated as controlled service, the 1-cent rate may be included."

Following the general lines of this plan full residence service schedules have been designed and put in effect in sixteen companies of the Middle West System. Typical of these schedules is the one developed for Central Illinois Public Service Company, one of the operating units serving 470 communities in central and southern Illinois. This schedule is quoted in two parts, as follows:

Uncontrolled service

$2.50 net per month for the first 40 kw.-hr. or any part thereof used per month.
4 cents net per kilowatt-hour for the next 100 kw.-hr. used per month.
2 cents net per kilowatt-hour for all additional use.

Controlled service

1 cent net per kilowatt-hour for all energy used.

Minimum bill

Without water heater.....$2.50 per month.
With water heater.....50 cents per month additional.

To qualify for this rate it is only necessary that the customer be using a standard range in addition to his

lighting and small appliances. The refrigerator or water heater may or may not be used. As the full residential service must be built around the electric range, this rate schedule is made available only to those customers using a standard electric range of not less than 5,000 watts connected. The customer must not only own the range but must use it twelve months in the year in order to qualify for this schedule.

One circuit is provided for the uncontrolled service, which is available all hours of the day and on which the customer operates the lighting, ordinary appliances, range, refrigerator and any uncontrolled units of his electric water heater. The 1-cent rate for controlled service is available only when a water heater is installed on a separately metered circuit, controlled by a time switch, upon which only the controlled element (bottom unit) of the water heater may operate.

The application of this rate to an average full-use customer will illustrate the cost of operating the three major appliances. It is estimated that the monthly requirements of an average full-use customer will be as follows:

	Kw.-Hr.
Lighting and ordinary household appliances	30
Electric refrigerator	60
Electric range	125
Electric water heater	300
Total	515

All of the service, with the exception of the kilowatt-hours used by the controlled element of the water heater, will be billed at the uncontrolled service rate.

It is common practice to provide storage type water heaters with two heating elements, one lower and one upper, controlled by thermostats, the upper element being larger and used to supply only a small quantity of hot water for emergency service. To insure adequate hot water service at all hours of the day the upper or emergency element is uncontrolled and is, therefore, connected to the uncontrolled circuit. Under average conditions the emergency unit of the water heater will use approximately 35 kw.-hr. a month, which will usually be billed at the 2-cent bottom step of the uncontrolled service rate. The remaining 265 kw.-hr. for water heating will be used by the controlled element and be billed at the 1-cent rate. This results in a total cost for water heating service of $3.35 a month or an average rate of 1.11 cents for the 300 kw.-hr. used.

The following table will illustrate the cost to the customer for the use of the various major appliances:

Service Used by Customer	Kw.-Hr. per Month	Cost in $ per Month	Total Average Rate, Cents per Kw.-Hr.
Lighting and ordinary household appliances and electric range	155	$7.00	4.52
Electric refrigerator	60	1.20	2.0
Lighting, ordinary household appliances, electric range and electric refrigerator	215	8.20	3.81
Electric water heater	300	3.35	1.11
Lighting, ordinary household appliances, electric range, electric refrigerator and electric water heater	515	11.55	2.22

Inducement features

In July, 1932, there were 8,972 electric ranges being used by customers of Central Illinois Public Service Company. By the end of March, 1934, this had decreased to 8,212, representing a loss of 560 ranges during that period. The standard range rate, prior to the full-use schedule, provided for a separate meter with the first 10 kw.-hr. at 10 cents and the excess at 3 cents per kilowatt-hour. Most of these customers still have the range and the company has made an investment to serve them, but many have discontinued the use because of the operating cost. The new full-use rate will recover much of that lost business because the customer obtains a lower rate for all service providing the range be used. This is particularly true of those customers using the refrigerator because in that case most of the energy for the range will fall on the 2-cent step of the full-use schedule.

This rate will promote the purchase of each of the three major appliances, namely, ranges, refrigerators and water heaters, because the average rate will be less than 2½ cents per kilowatt-hour.

Why two meters

IN THE past electric utilities have endeavored to provide rate schedules requiring but one meter for a residence, and rightfully so. The advantages of a one-meter rate are well recognized. In a plan of this type, however, certain compromises must be made. A rate of approximately 1 cent per kilowatt-hour is necessary if a reasonable share of the water heating business is to be obtained. To provide a 1-cent rate in a one-meter schedule would result in the operation of other than controlled water-heating service at the 1-cent rate. Under present conditions the companies in this system can afford to offer the 1-cent rate only for the controlled water heating. If the 1-cent step be included after a use large enough to exclude all uncontrolled use, then a considerable amount of controlled water heating would fall into the 2-cent step of the rate. After further experience with this rate and the development of a larger volume of full-use service it may be possible to design a one-meter rate which will satisfactorily compromise between these two obstacles.

Lends itself to advertising

The simplicity and uniformity of the full-use schedule make it readily adaptable to advertising programs. The rate for this company provides 40 kw.-hr. for the $2.50 monthly minimum bill with energy steps of 4-2-1 cent per kilowatt-hour. Other companies in the system include 30 or 35 kw.-hr for the $2.50 and 90, 100 or 110 at the 4-cent rate, depending upon local conditions. In all cases, however, the minmium is $2.50, including some kilowatt-hours and the energy steps 4-2-1 cent per kilowatt-hour. The schedule is uniform throughout the territory served by any one company, regardless of the variation that may exist in the present residential schedule by reason of the different populations of the communities served.

In spite of all the effort exerted by utilities in the past to emphasize the lower steps in the residential rate schedules, the rates are still usually referred to by the top steps. The simplicity of this rate and its uniformity throughout the territory of each company will enable the further stressing of the lower brackets in the rate in a manner that should assist in convincing the customer that for full use of service the total average rate is 2.2 cents per kilowatt-hour and much of the energy is being purchased at 1 cent. A simple advertising cut may be prepared showing the minimum bill of $2.50, including 40 kw.-hr. with the energy steps at 4-2-1 cent per kilowatt-

hour, presenting all steps in the rate with increasing emphasis toward the lower steps. Another part of the cut may show in large figures the total average rate of 2.2 cents per kilowatt-hour for customers making full use of the service. Such a cut may be inserted in all merchandising ads. Circulars, letters and news articles may all refer to the "full-use" rate, which name suggests its availability. In cases where the bills show the breakdown in kilowatt-hours by steps these 4-2-1 cent figures may be placed on the bill, together with the $2.50 including 40 kw.-hr., which figures may be presented in rather bold type. Most companies now showing the breakdown on the bill do so by showing the kilowatt-hours in the first step, second step and third step in the rate, without mention of the price charged in each step. The prices are omitted in view of the different rates for different size towns. With the uniformity provided in the full-use schedule the price of each step may be placed on the bill so that the customer will see each month that he is purchasing energy at 4 cents and 2 cents and 1 cent per kilowatt-hour. This constant reiteration will finally make customers conscious of the lower and lower cost of electricity as the amount of use is increased.

Why limited to residential range users

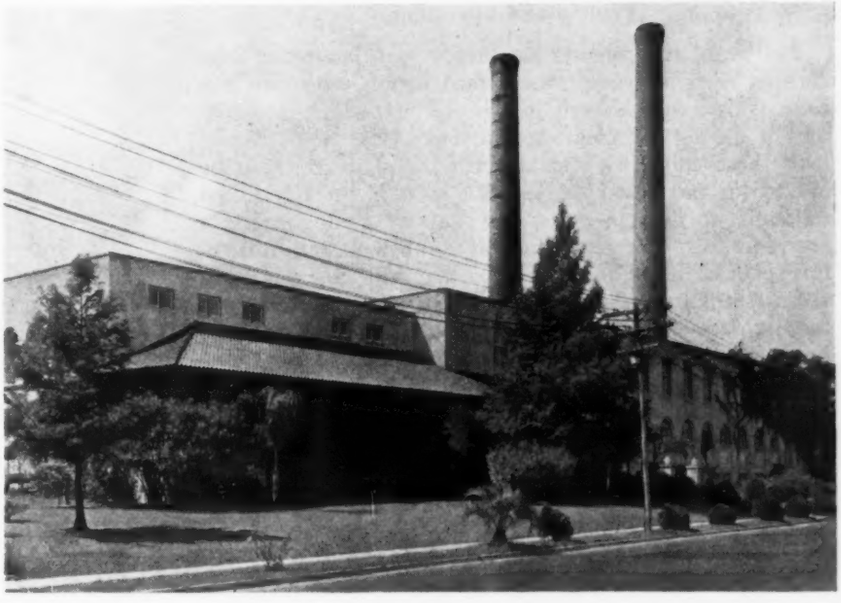
Under present production costs and with the present average use of service by residential customers it is possible to sell energy profitably at 1 cent only under certain restricted conditions. The companies cannot afford any increased investment above the meter and time switch. The 1-cent rate must be limited to purely off-peak business, off-peak from the standpoint of the power plant and off-peak from the standpoint of the local distribution system. In cases where the customer has installed an electric range the company has already provided local transformation and distribution capacity. This local capacity is used at present during limited hours of the day, being so limited by cooking habits of the customer. The electric water heater of a storage type is adapted to this particular condition in that the water can be heated at night or during the off-peak period when ranges are not ordinarily in use. This is a condition that does not exist with commercial customers or with power customers or with any residential customers, excepting those using electric ranges.

Commissions and courts have long upheld the sound practice of dealing in class rates for utilities' service. The practice is a necessary one and benefits the customer as well as the company. It is entirely reasonable to consider residential range users as a class. The load factor of this group of customers as a class is higher than other residential customers, commercial customers or retail power customers, considering each as a class, thereby justifying the lower rate. This is particularly true when the water heater is added.

The full-use rate, therefore, is limited to residential range customers because only under the conditions of this limitation is the 1-cent rate justified.

The Power House of "The City Beautiful"

Located on a state highway skirting a lake* on the north side of Orlando, Fla., just a dozen blocks from the business center and not far from residential sections, the power house of the Orlando Utilities Commission occupies a more conspicuous position than most power plants, so far as touring motorists and citizens are concerned. Consequently, to live up to the civic slogan of "The City Beautiful" and to maintain the good will of the citizens, it was necessary, in building the station and landscaping the grounds, to make it as attractive as an industrial establishment can be made without inordinate expense.



As a result the plant is one of the first imposing sights that greet the eyes of tourists entering Orlando. Situated and landscaped as it is, it might be mistaken for a park administration building, were it not for the smokestacks. Only a modest inscription near the entrance designates its character. In the daytime the palms, shrubbery, well-kept lawn and brilliantly-hued flower beds give a mild introduction to a city which displays its civic pride throughout its area. At night concealed floodlamps illuminate the white stucco front of the plant just enough to silhouette the graceful palms.

This is just one example of what can be done with utility buildings, including substations, where they are situated in conspicuous places. At least they can be made to appear as well as their surroundings, or, as in this case, more attractive, without much additional expenditure of money. Buried water piping connected at intervals to spray heads that are flush with the ground facilitate regular irrigation without interfering with mowing of the grass.

Circulating water supply.

A New Voltage Regulator

A Progressive Development in Transformer Construction with Moving Coil Control, Hand or Automatic Operation, Low Losses and Impedance Values

By E. T. NORRIS
Chief Designer, Ferranti, Ltd., England

A NEW regulator has been developed to vary the voltage in an electrical circuit smoothly and without interrupting the load. It may be applied to the control of voltage in power transmission and distribution circuits and, in addition, there are a large number of industrial and laboratory applications, such as the maintenance of constant temperature in electric heating processes, the regulation of rectifiers and the control of high voltage in X-ray and testing apparatus.

A characteristic feature of the new regulator is a short-circuited coil of transformer type moving up and down the leg of a laminated iron core, hence the title "moving coil" voltage regulator. The general characteristics, such as cost and efficiency, compare favorably with other available apparatus.

Principle of operation

The regulator consists essentially in a laminated iron core as used in transformer construction with two circular coils *a* and *b* fixed in position at the top and bottom of the leg and connected in series (Fig. 1). Sliding over these coils is a movable coil *s*. This coil can be moved up and down the leg, but as it is short-circuited on itself no flexible leads, slip-rings or sliding contacts are required. The impedance of coil *a* will depend upon the position of the moving coil *s* and will vary smoothly from a small value when *s* is immediately over *a*, to a large value when *s* is at the other end of the leg. The impedance of coil *b* will vary conversely in the same manner. If, therefore, coils *a* and *b* in series are connected to a source of supply the voltage across the individual coils will depend upon their relative impedances and will vary from a small proportion of the supply voltage to a large proportion, depending upon the position of the coil *s*. It will be seen (Fig. 1) that with an impedance variation of 40/1, the voltage across coil *a* can be varied smoothly and uniformly from 2.5 to 97.5 volts by varying the position of the moving coil.

The simple arrangement just described gives a fixed range of variation and definite voltages in relation to the supply voltage. Almost any desired value of voltage and variation can be obtained, however, by means of auxiliary coils connected in series with the load and mounted in close inductive relationship with the fixed coils *a* and *b*. For example, an arrangement giving an output voltage varying from zero to 150 volts with an input voltage of 100 volts is shown in Fig. 2. The turn ratio of coils *r*

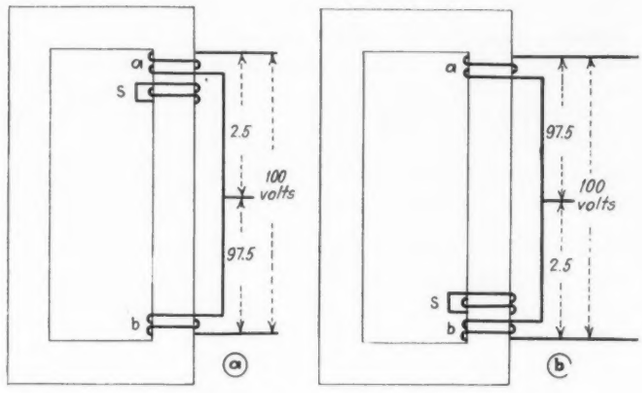


Fig. 1—Essential principle of regulator designed for smooth voltage variation

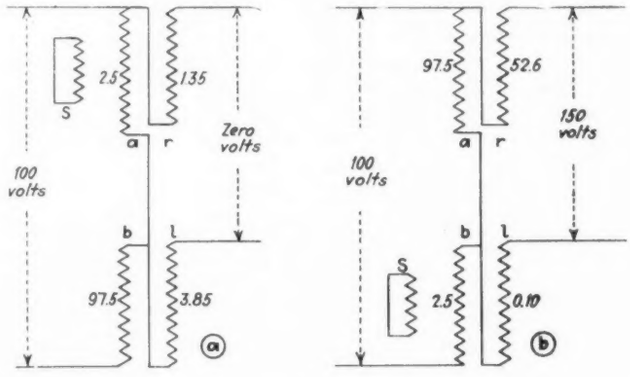


Fig. 2—Arrangement to vary output voltage from 0 to 150 for 100 volts input

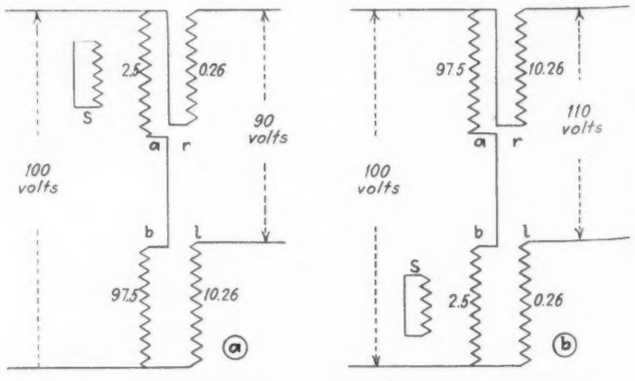
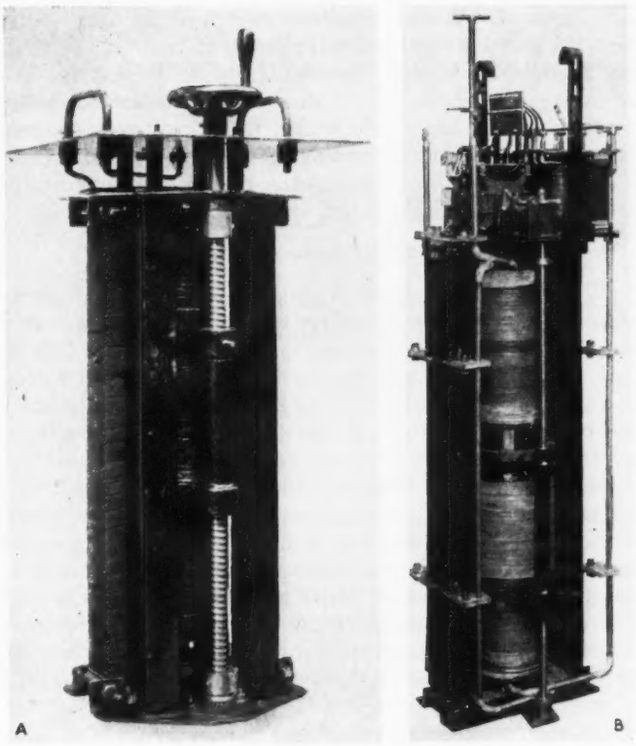


Fig. 3—Arrangement for ordinary voltage regulation of distribution circuits



Figs. 4 and 5—Small ones hand-operated, larger ones have motor

(a) A hand-operated regulator for 100 per cent variation in a 1.25-kva., 200-volt circuit. (b) In larger sizes the moving coil is operated by two square threaded shafts. A 10-kva., fully automatic regulator giving ± 10 per cent variation on 6,900 single-phase circuit.

and a would be 1.85 and of b and l 25.3. The output voltage in the minimum position will then be

$$2.5 - (97.5 \div 25.3) + (2.5 \div 1.85) = 0$$

and in the maximum position

$$97.5 - (2.5 \div 25.3) + (97.5 \div 1.85) = 150$$

Output voltages independent of the supply voltage may be obtained by isolating the auxiliary coils r and l to form a separate secondary winding. The regulator then acts as a double-wound transformer in addition to providing the required voltage variation.

Wide ranges of voltage variation are only required for industrial and laboratory application. In transmission and distribution circuits variations of 10 and 20 per cent are sufficient. These values can be obtained by the arrangement shown in Fig. 3, in which only the auxiliary coils r and l are connected in series with the load. An arrangement giving 10 per cent buck and boost is shown in Fig. 3, the minimum voltage being

$$100 + 0.26 - 10.26 = 90$$

while the maximum voltage is

$$100 + 10.26 - 0.26 = 110$$

By choosing suitable turn ratios for coils r and l any desired values of buck or boost can be obtained.

The novelty of the new regulator lies not in an electromagnetic arrangement of coils and cores whereby movement of a core or coil (whether linear or angular) varies an induced voltage and thereby permits voltage regulation. Many such regulators have been devised in the past. The difficulty is to produce an economical and practical arrangement which will at the same time be reasonably efficient and have low losses and impedance values. The impedance conditions are particularly difficult to obtain. The ordinary single-phase induction regulator, for example, in its simplest form has an extremely high impedance in the neutral position and is only practicable because it is possible to reduce this impedance by means of a special short-circuited coil wound on the rotor. The regulator just described has a reasonably low and uniform impedance over its whole range without the use of auxiliary short-circuited coils.

Construction of regulator

In general, the construction follows the same lines as ordinary static transformers. The laminated iron core, coils, insulation, structural work and general assembly are in accordance with standard transformer practice. There are no windings in slots, and the regulator can, therefore, be designed for heavy currents and high voltages without the need for shunt and series transformers. The moving coil is carried in a non-magnetic frame operated by a vertical square-threaded shaft. For automatic operation the mechanical drive is by an induction disk motor through a single bevel or worm gear. In the larger sizes the moving coil is supported on both sides and operated by two square-threaded vertical shafts. In all types of regulator except the largest sizes all the mechanical operating gear, including the motor, is oil immersed, the design being such that the only part of the apparatus needing any inspection or maintenance is installed in a small control box on the side of the regulator tank.

Technical characteristics

Technical characteristics of the moving coil regulator are the same as for an ordinary transformer. Some of these characteristics vary with the voltage, but for a given regulator position the performance can be expressed in standard transformer terms and the same vector diagram will apply. In order to reduce the current in the moving coil, windings a and b are connected in opposition so that the currents they induce in the moving coil tend to neutralize. This connection has no other effect on the operation of the regulator, but as a result there is no current in the short-circuited coil at no load for any position of the regulator. On load the current is proportional to the load current and still independent of the regulator position. The no-load current is practically constant for all positions of the regulator for a constant primary voltage, and only differs from the corresponding transformer no-load current in that due to the large proportion of air path in the magnetic circuit its wave form is practically sinusoidal.

Neither single-phase nor three-phase moving coil regulators have any inherent voltage phase displacement

Voltage regulation is a constant source of trouble which has long confronted distribution engineers. This new and interesting development from England brings a notable contribution to the solution of this prevailing problem. Two years of operating experience indicate peculiarly advantageous features.

in any regulator position. In this respect they are similar to single-phase induction regulators and to twin three-phase induction regulators.

Mechanical forces and noise

Due to the absence of small air gaps and moving magnetic cores the mechanical forces in the moving coil regulator are negligible in comparison with those in the ordinary induction regulator.

The moving coil is operated on by forces in opposing directions from fixed coils *a* and *b* at either end of the leg. These forces tend to press coils *a* and *b* against the framework. The mechanical structure is here exactly the same as in ordinary static transformers. The resultant force on the moving coil is extremely small due to this neutralization and is zero at no load for any position of the regulator. In standard regulators the maximum force on the moving coil in the worst position at full load is only one-third of the weight of the coil itself. These negligible forces render the regulator completely short-circuit-proof. It is not necessary to install current-limiting reactors, as is the case with the ordinary induction regulator. The small mechanical forces mean correspondingly small vibration. In general, the noise emitted by the moving coil regulator when in service is appreciably less than by an ordinary static transformer and at no load (that is, usually during the night) noise is negligible.

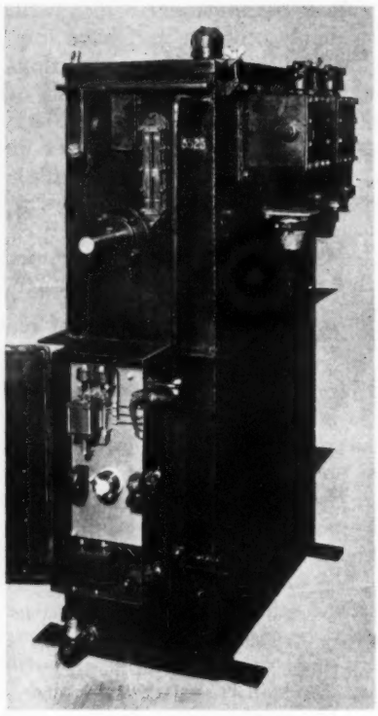


Fig. 6 — Three-phase fully automatic moving coil regulator giving 8 per cent boost in a 400-volt, 100-kva. circuit. Note simple control box for automatic operation.

Automatic operation

As a result of the small mechanical forces the power required to operate the regulator is also small and for all except the largest sizes a single-phase motor of the induction disk type is sufficiently powerful. This motor runs at a very slow speed (150 r.p.m.), so that little mechanical gearing is required. Since the rotor consists of a plain copper disk, it is eminently suitable for operating under oil, and in the case of oil-immersed regulators is so immersed and thereby protected from damage and atmospheric conditions. The motor takes no more current at starting than when running under full load. It can, therefore, be stalled without any risk of damage, so that limit switches and overload devices are unnecessary. The motor is controlled by a contact-making voltmeter through small mercury switches and no auxiliary relays, time-delay relays or automatic brake are required. With the control switch in the "off" position the panel is dead and adjustment to the relay setting, etc., can be made with the regulator still in service.

The great simplicity of this automatic control gear, in that neither automatic brake, time-delay relays, auxiliary relays, contactors, overload devices nor limit switches are required, makes the regulator economically suitable for relatively small distribution circuits.

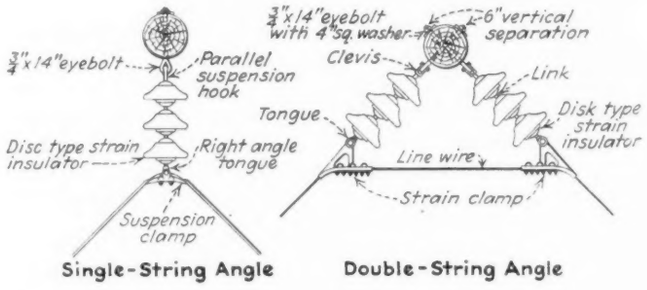
General characteristics

While the moving coil regulator is similar in operation to the ordinary induction regulator in that it varies the voltage smoothly and not in steps and can be left in any position, it is distinctive in that the mechanical forces are very small and the moving parts are entirely isolated electrically. Moreover, it has the design characteristics of the ordinary transformer rather than the induction regulator; it can be designed for high voltages and heavy currents, and can be economically built in very small sizes. The limitation here is not the cost of the regulator itself, but of the mechanical operation and automatic control gear. Values of impedance, no load current and of losses in relation to price can be controlled in the same way as in an ordinary transformer by altering the coil proportions and connections and the ratio of iron to copper.

Operating experience during the past two years, both with hand and automatic controlled regulators, has been entirely satisfactory and indicates that in comparison with apparatus hitherto available the new regulator has a number of characteristics peculiarly advantageous and none that is seriously objectionable.

Dead Ending on Poles

It is often difficult to trace a new idea to its orginator. After many years of complicated corner construction by means of crossarms, braces, etc., some one took the bull by the horns and dead ended directly to the pole, and now this type of construction is quite common on the better types of lines that point to the hand of the skillful designer.



This type of construction can be accomplished either by one or two strings of insulation per conductor, depending on the angle as is shown for 22,000 to 33,000-volt construction in the accompanying illustration of the West Penn Power Company. Vertical separation of line wires is not less than 4 ft. Angle poles ordinarily are graded 5 ft. higher and the adjacent poles 2½ ft. higher than normal. Corners are turned on crossarms if angle is less than 30 deg.

Penstock Maintenance and Protection Costs Analyzed

A Successful Solution of the Problem of Preventing Deterioration of the Interior of Steel Pipe Lines

By J. S. McNAIR*
Washington Water Power Company, Spokane, Wash.

PROTECTING the interior of a penstock probably represents one of the most difficult problems in maintaining hydraulic structures. That coating which gives complete protection for the maximum length of time at the minimum cost per year of useful life, other factors being equal, is of course the most efficient and valuable coating, particularly when considering the system-operating difficulties and the cost of removing a penstock from service for the length of time required for properly painting and recoating the steel.

In order to determine the type of coating best meeting the requirements for protection of hydraulic structures of the Washington Water Power Company the engineering staff made a study of the various kinds of paints and coatings available for this service by actually testing each under service conditions. Some were applied in selected sections of penstocks where each test section would receive the same service; vanes of waterwheels also were utilized and each vane painted with a different coating for the test. Test conditions to which each coating was subjected in this manner were identical, but the tests were accelerated to the higher velocities and turbulence of the water.

Briefly, the results of these observations showed that many of these coatings had disappeared entirely at the end of two or three years, leaving the bare metal exposed. Others had blistered and softened to the extent that they were giving incomplete protection and still others had checked and chipped so that they were no longer furnishing full protection. In this connection it is interesting to note that observations indicate there is no economy in providing extra thickness of steel in the design of a penstock above that required for the usual factor of safety to take care of pitting. In the Chelan penstock one-sixteenth of an inch was allowed for this purpose and this amount has already been lost in places, due to rusting, in a period of seven years, thereby presenting the problem of providing a protective coating in spite of the original precaution.

While searching for a better type of protective coating with a longer life, the bituminous type of coating was first tried in 1926. In 1928 the three penstocks of the Post Falls plant were cleaned and coated with "Biturine" enamel, which, at the last inspection, seven years later, was found to be in excellent condition and gave every evidence of long years of service yet to come.

To summarize, it may be said that the experience of this company indicates that bituminous coatings, such as Biturine enamel, are superior to other types of coatings. They have the longest useful life of any coating thus far tried by us. The initial cost of the material and extra labor expense in applying the enamel are twice to three times the cost of other coatings tried, but its longer useful life, which we roughly estimate to be 30 years at least, more than offsets this extra initial cost, as the cost per year of useful life is much less.

For instance, the penstocks at the Long Lake plant were cleaned and coated with a primer coat and two cover coats of short-lived coating, the cleaning costing $0.12 per square foot and the coating $0.0344 per square foot, making a total cost per square foot of 15.44 cents. This coating had practically disappeared after three years' service, making the total cost per square foot per year of service 5.12 cents. The cost of applying the Biturine enamel coating was approximately 13 cents per square foot, which with the cleaning cost brings the total cost per square foot to 28 cents. The average cost per square foot per year of service to date is 4.66 cents and the coating still shows no evidence of deterioration. This cost should decrease with the additional years of life indicated above. In the above cost figure no account is taken of the possible loss of revenue and operating difficulties due to having to take the penstock out of service frequently, as will be required with a short-lived coating. Neither has the improved coefficient of friction due to a smooth surface over a corroded surface been evaluated, although this is estimated for the Chelan plant, having an installed horsepower of 72,500, to be a gain of about 900 hp. Capitalized, this gain would several times exceed the cost of a long-lived coating.

Experience of the Washington Water Power Company indicates that a rapid deterioration of steel structures immersed in water may be expected unless high quality protective coatings are applied. Cheap protection often proves to be expensive.

*Abstracted from a report of the Northwest Electric Light and Power Association production and generation committee, 1934.

When sections revealed that corrosion was gradually becoming worse in the penstocks of the Chelan power station, completed in 1927, it was decided to coat the penstock interiors with the bituminous protective coating, the work being started early this year. The job involved approximately 80,000 sq.ft. of steel, subjected to continuous immersion, which was to be cleaned and coated.

In the interest of brevity the details of preparation and factors influencing the decision to do the work at that time are omitted. The field work was commenced February 12, the penstock unwatered February 15, the job was completed March 31 and the station was in service on April 2, twelve days ahead of schedule.

Sandblasting best for cleaning

HAND scraping and brushing proved unsatisfactory because of the high unit cost and the unsatisfactory results obtained. By this method the hard scale could not be removed and the pitted areas were not cleaned satisfactorily. An electric-driven concrete surfacer could not clean effectively around the rivet heads, nor could it get down into the recesses between the ends of the plates at the strap joints nor into the corners of the lap joints. Use of disk-type wire brushes mounted on and driven by portable electric hand grinders was also found to be unsatisfactory as the unit cost was high, they were tiresome and dangerous for the operators to use and did not satisfactorily remove barnacles or hard scale. Air motor-driven brushes, using brushes made of steel piano wire shaped in cups of various sizes, were more satisfactory than the preceding methods, but the unit costs were high, along with other disadvantages disclosed.

Sandblasting proved to be the most successful method of cleaning and preparing the surface of the penstock for receiving the priming coat. Various combinations of air jet tips and pressures were tried, with the result that a good combination was discovered. This consisted of an assembly, having an air jet tip with an orifice $\frac{1}{2}$ in. in diameter, a nozzle 1 in. in diameter, and a wye made by using two pieces of double extra heavy steel pipe, welded and case-hardened to form the wye or body of the blaster. The air jet tip was made of octagon tool steel, the nozzle being a piece of 1-in. standard pipe about 8 in. long, case-hardened. By using this equipment and maintaining a pressure of approximately 125 lb. per square inch it was possible to sandblast and thoroughly clean an average of 180 sq.ft. per hour per gun, and on a test of a few hours' duration this rate was exceeded considerably. Local sand obtained from a nearby pit was used in the operation. The sand was cleaned, dried and passed through a No. 6 screen and over a No. 10 screen and was composed of a mixture of basalt and dark colored quartzite with a small proportion of decomposed granite.

Pitted surface cleaned thoroughly

Examination of the steel cleaned by this method with a 60-power magnifying glass showed that practically all of the rust had been removed from the surface, including the bottom of the pitted areas, and that the cleaned steel had an appearance of being etched rather than polished, thus providing an ideal surface for the teeth or bonding of the priming coat. In addition to its speed and low cost, the sandblasting has the additional advantage of being able to clean around the rivet heads quickly and thoroughly.

Table I—Direct Labor Costs for the Various Methods of Cleaning Penstocks

Method	Man-Hours Worked	Surface Cleaned, Sq.Ft.	Total Cost	Cost per Sq.Ft.
Hand scraping	173	1,809	$86.51	$0.047
Rotary wire cup brushes	48	400	$29.11	$0.727
Electric-driven buffer wire brushes	79	200	$36.96	$0.184
Electric concrete surfacers	192	666	$89.02	$0.135
Sandblasting (including screening, drying, sacking, and removing sand)	416	4,752	$194.62	$0.409

Table II—Direct Labor Costs for Applying Primer and Enamel

Operation	Man-Hours	Surface Coated, Sq.Ft.	Total Cost	Cost per Sq.Ft.
Hot Coating				
Priming	81	10,000	$42.93	$0.0043
Hot coating	175	6,138	$111.23	$0.0237
Transporting paint and kettles	80	6,138	$34.00	.....
Total direct labor costs			$145.23	$0.0280
Cold Painting				
Priming	45	2,900	$31.21	$0.011
Enameling	37	1,308	$25.45	$0.019
Total direct labor costs			$56.66	$0.030

In preparing the tabulation of costs shown in Table I direct cleaning labor costs only have been considered. Other costs would be approximately the same regardless of the method used for cleaning and they have been disregarded in setting up comparative costs.

Enamel applied hot

Biturine enamel primer was applied cold by hand brushing. The enamel was applied at a temperature of approximately 400 deg. F. using No. 2 Tampico daubers, with a brush stroke of about 10 in., overlapping on the ends and sides about $1\frac{1}{2}$ in.

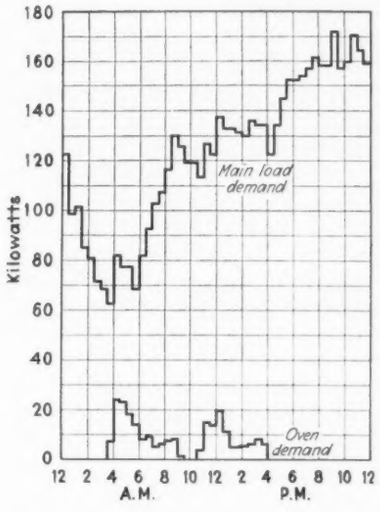
To heat the enamel, two heating kettles were made of No. 12 gage sheet steel about 5 ft. long, 19 in. deep and 20 in. wide. The stand, consisting of legs and No. 20 gage sheet steel housing, was made so that it could be split in half, which construction allowed the stand as well as the kettle to be taken into a 30-in. diameter vent tube or similar opening in the penstock. In order to heat the kettle a 5-ft. length of 3-in. cast-iron soil pipe, perforated, was installed between the bottom of the kettle and the housing. Kerosene preheating torches were used to heat the kettles, each consisting of a heavily constructed 5-gal. container having a handle for carrying and fitted with compressed air hose connections, pressure gage and connections for two small hose lines leading to the burner proper. The cast-iron tip of this burner was placed in the bell end of the soil pipe under the kettle. With this arrangement the heat was distributed evenly the entire length of the kettle.

Because of the space limitations within the penstock the coating crew consisted of three coaters, one passer, one kettle tender, one to four transfer men inside, one hoistman, one outside transfer man and one man to break up and sack the enamel. Costs for priming and enameling the penstock are shown in Table II.

As many as 115 men were employed during the seven weeks' period while the penstock was being cleaned and coated. Notwithstanding the fact that most of the men were inexperienced in this type of work, safety regulations were stringently enforced, with the result that there was only one lost-time accident and that of a minor nature.

240-Loaf Hotel Oven Bakes on 7.5-Mill Kw.-Hr. Rate

By H. H. STEINBERG
Electric Heating Division,
Edison Electric Illuminating Company of Boston, Mass.



Hotel oven operates off-peak on low energy rate

By operating off-peak, two electric bakeovens used by the Hotel Bradford, Boston, Mass., for bread and pastry production secure an increment energy rate of 7.5 mills per kilowatt-hour. A recent eight-day test was made with demand and energy meters connected to the line supplying the ovens while the baker tallied his production. For an electric heating cost of 89.3 cents per day the bakery turned out 30 pies, $25 worth of small cakes, 4,000 rolls, 45 loaves of 6-lb. bread, fifteen loaves of French bread, twelve loaves of rye bread and 30 doz. muffins. The average energy consumption for the eight days was 119 kw.-hr. per day and the daily readings totaled between 100 and 142 kw.-hr.

Service for the entire hotel is obtained from the Boston Edison Company on its general wholesale rate "D," as follows: Demand charge, $175 per month for the first 50 kw. of demand; $3 per kilowatt per month for the next 600 kw. of demand and $2 per kilowatt per month for the excess. The energy rate for the hotel is 2.5 cents per kilowatt-hour for the first 9,000 kw.-hr. per month and 7.5 mills per kilowatt-hour for the excess. The monthly demand is the average of the twenty highest half-hour loads (not over two in one day), and the highest of the twelve monthly demands preceding the date to which the bill is rendered, is the demand for that bill.

Electric oven delivers uniform product under most favorable working conditions

Swiss Crematorium Is Wholly Electrical

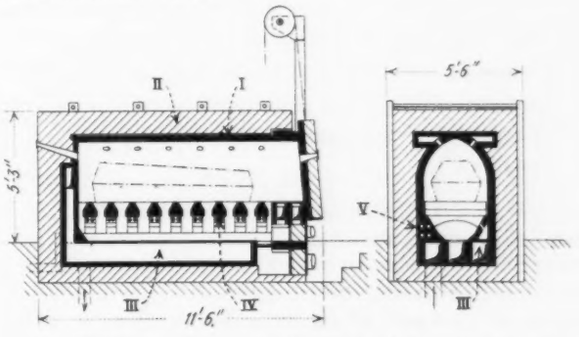
An 80-kw. electric crematorium in Biehl, Switzerland, consumes about 30 kw.-hr. per cremation after the initial preheat period, which requires about 450 kw.-hr., as against some ⅓ ton of coke or 25 to 30 cubic meters of gas. The dimensions also are found to be greatly reduced, as reported in the *Bulletin de l'Association Suisse des Electriciens* for June 22, 1934.

The coffin is placed in a steel chamber, only slightly larger than the coffin itself. On the bottom of this chamber are arranged several cross tiers of heating units, forming a grill upon which the coffin rests. The front of the steel chamber can be closed with a hermetically sealable door. Surrounding the steel chamber is a heavy inclosure of heat-insulating materials.

Through a small and adjustable orifice fresh air is sucked by electric fans through a series of steel tubes, around which are arranged other sets of heating units. Several hours before the actual cremation the internal grill units are turned on to preheat the furnace to 700 deg. C. (1,292 deg. F.). After the coffin is in place further heat is supplied only by the heated air coming through the recuperator steel tubes.

The heaters and the fans absorb a total of 80 kw. and the actual cremation is completed in about 100 minutes. Thermocouples are placed at various points in the chamber and the passages, and in conjunction with relays a steady maximum temperature of 700 deg. C. is automatically maintained in the chamber. Once set for time and temperature the entire process of cremation requires no attention.

It is stated that from the standpoint of the bereaved the absolute cleanliness of the electric process and the absence of any fire or flame are of great psychological and sentimental value.



Longitudinal and Cross Section Through Cremation Furnace

I - *Fireproof lining (of steel casing)*
II - *Heat insulation*
III - *Exhaust combustion canals*
IV - *Heating units for preheating*
V - *Tubes and heaters for supplying combustion heat*

Swiss city cremates its dead electrically

Standardization and Profits

By
R. E. HELLMUND
Chief Engineer
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

STANDARDIZATION of any kind is justified only if it brings about economies or other advantages and if it does not unduly interfere with progress. Vast economies could be accomplished by a great deal more standardization, but with the usual processes of arriving at standards so much time is consumed that the full value of such possible economies is never obtained. On the other hand, the instances where standardization has interfered with progress are extremely rare.

These statements fully apply to standardization by preferred numbers, which should be used to a much greater extent than they have been in the past. They not only offer an excellent tool for working out standardizations, but their frequent and liberal use will materially speed up the establishment of standardizations. One reason why this useful tool, which in itself is so simple that it can be understood by a child in the fourth or fifth grade or by any laborer of ordinary intelligence, has not been used to a greater extent is that it has been shrouded with a good deal of mystery by many mathematical discussions, by curves on logarithmic paper, long-drawn-out arguments on the merits of different systems, and the like. The reason why the engineering profession as a whole has not taken more interest in the system is that it and its utter simplicity have not been sufficiently advertised.*

Stripped of all mystery and of mathematical formulas and expressions, preferred numbers are simply groups of certain numbers which should be used in preference to any others whenever a standardization of ratings, dimensions or what not is desirable.

As a matter of course, the various national and international committees intrusted with the selection of these preferred numbers have endeavored to provide logical series of numbers; for example, they have devised one series of numbers giving five steps between 1 and 10 or between 10 and 100, etc., with the steps so arranged that each number is approximately 60 per cent larger than the preceding one. This group of numbers is called the "5 series." Similarly, groups of numbers having 10, 20 and 40 steps between the numbers 1 and 10 or between 10 and 100, etc., have been selected and are known as the 10, 20 and 40 series respectively. In the table on page 211 are the numbers of the 5, 10, 20 and 40 series between 10 and 100 as contained in the preliminary American standard in which a few numbers differ slightly from those in the proposed international standard.

Preferred number sense for furniture

Let us assume, for instance, that the width of a square-top card table is to be selected. It is known from experience that a size somewhat over 30 inches is convenient for this purpose. By reference to the table, it is at once evident that in this case a width of 32 in., taken from the 10 series, should be selected, because the nearest numbers shown in the 5 series, namely, 25 and 40, would not be practical for this particular case. With reference to the height of the table, it is known that a convenient dimension is between 27 and 29 in. In this case the nearest numbers (25 or 40) in the 5 series, as well as the nearest numbers (25 or 32) in the 10 series, would naturally interfere with convenience, and common sense therefore dictates the choice of 28 from the 20 series for the height.

There is no question that the standardization of the dimensions mentioned is highly desirable, because frequently a number of card tables are joined for use when a luncheon is served, which obviously makes it desirable to have both the width and the height of all tables alike. For tables used in dining rooms, kitchens, etc., a somewhat greater height, in the neighborhood of 29 to 31 in., is more convenient. It is therefore at once evident that 30 in., from the 40 series, should be selected.

For the height of dripboards and cupboards in kitchens dimensions between 35 and 37 in. seem to be convenient; therefore the selection of 36 from the 20 series is desirable. For the seats of straight chairs a height between 17¼ and 18½ in. seems to be comfortable and therefore the selection of 18 from the 20 series would be logical. Smaller persons selecting a desk chair for their own use may prefer a somewhat lower height, so that a semi-standard of 16 in., taken from the 5 series, might be used for this purpose. (All these examples are given here merely for the purpose of illustration and should not be construed as a proposal on the part of the writer to disturb any satisfactory standards already existing.)

Competitor used to establish the preferred numbers

The examples given so far relate to the choice of a single number for a definite purpose, the selection in all cases being governed by convenience or utility. In other cases a series of several numbers may have to be selected for the standardization of a line of devices or apparatus, a typical example of this being the horsepower ratings of a line of electric motors. When electric motors were first developed, and for many years

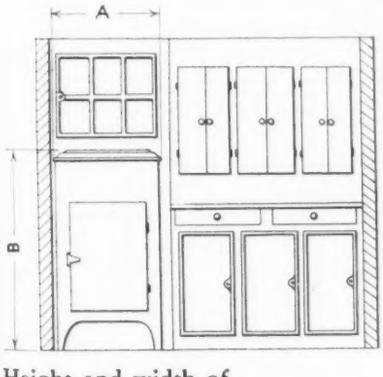
*There is one more important factor which has retarded the use of preferred numbers for dimensions within the range for which the numbers are not integral numbers, and that is that the present recommended series uses decimals instead of the fractions commonly used in this country. This point is now under consideration by the A.S.A. committee and it is expected that a series of fractional numbers will soon be available.

Aided by Preferred Numbers

"Topsyness" and frantic competition are to blame for the senseless steps in sizes of electrical products. This article takes the mystery out of preferred numbers and shows how orderliness and economy will result from their early adoption by producers. The author is chairman of the A.S.A. sectional committee on this subject.

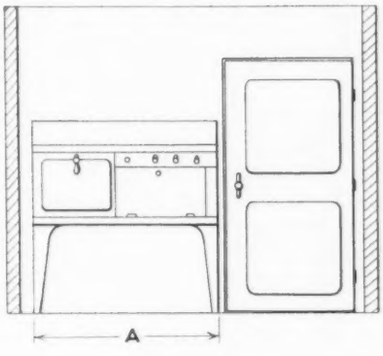
thereafter, there were no preferred numbers available, and as a consequence the independent choice of ratings by the different manufacturers led to a chaotic condition. For example, one manufacturer selected standard ratings of 20, 25, 35, 50 and 75 hp.; another selected 20, 25, 30, 50, 60 and 75 hp. Very soon, however, the manufacturer not having a 30-hp. motor found that he was handicapped whenever a customer called for that rating, and in order to meet the situation he designed a 30-hp. motor, which, of course, was out of line with his standards. Before long it came about that customers not only expected to obtain any one or both of the previously mentioned series of ratings, but they also demanded odd ratings not contained in either of the above series, such as 33, 45, 55 or 65 hp.

All of this, of course, meant appreciable economic waste, for which the users had to pay in the long run, and a real standardization and elimination of such waste was not accomplished until twenty or thirty years after the advent of the electric motor. Similar examples of chaotic conditions could be cited of practically every type of apparatus, such as generators, transformers, controllers, contactors, etc.; in some of the latter examples standardization was delayed even longer than in the case of motors. It is difficult to avoid such conditions, because in a new industry it will naturally take some time before trade associations or other bodies can be properly organized and subsequently reach an agreement. Assuming, however, that in the early stages of a new industry a system of preferred numbers was available and in general use, certain standards in the industry could be established long before standardization by the interested associations was feasible. With the motor ratings referred to above it would have been quite easy for any of the individual manufacturers to have started out with ratings of 20, 25, 32, 40, 50, 64 and 80 hp., corresponding to the 10 series.



Height and width of refrigerator call for preferred number rating

Architect-fixing of window heights and alcove widths in modern-kitchen layouts demand standardization.



Over-all width of range a place for preferred number application

Refrigerator is a horrible example

Unfortunately, however, even today, when preferred numbers are available, industry is not taking advantage of them to any extent. Reference might be made to one of the more recent industries, namely, that of refrigerators, which are rated according to their cubic contents. Following are the standard ratings of one manufacturer for three years:

1931	1932	1933
2.7	2.6	
4.3	4.2	4.2
	6.1	6.2
7.3	7.2	7.5
9	9	9.3
	13.5	15.3
	30.1	21.8

Also a comparison of the ratings of two different manufacturers during the same period:

4.4	4.2	10.9	11	17.2	
6.3	6.	11.3		18	
6.7	7.2	13.6	13.5	18.3	20.1
9	9	14.8			

The practice of changing sizes still continues, and any attempt at this time to bring about standardization will naturally be difficult because it will mean changes in expensive tools of the various manufacturers to conform with whatever standardization is established. All of this could have been avoided by the selection of preferred numbers by any one of the individual manufacturers in the beginning.

In connection with refrigerators or similar devices used in kitchens, certain standardization of the main dimensions would also be of economic advantage because there are frequently marked space limitations, especially in the kitchens of small city apartments. If architects designing such apartments could have assurance that all standard makes of domestic refrigerators of a given capacity would not exceed certain widths they, without doubt, could make their plans to better advantage. Typical conditions are illustrated for a refrigerator and a range. The height of refrigerators is usually not of much consequence, but even here it happens at times that it is necessary to place one refrigerator under a win-

dow, and it would be of assistance if there were some assurance that the height of standard makes would not exceed certain dimensions selected from the preferred numbers series.

Number system lends itself to progress

It will be found that even in the simple cases discussed so far conditions will arise which will make it at times difficult to adhere strictly to the use of these numbers. To illustrate this, let us assume that a preferred number has originally been chosen for the over-all width of a refrigerator. Certain improvements in the heat insulation material of the box may subsequently make it possible to reduce the wall thickness. In order to take advantage of this, either the dimensions of the food liner or the outside dimensions of the refrigerator will have to be changed. It may be found relatively inexpensive to change the outside dimensions, while a change in the dimension of the food lining cabinet may mean expensive and therefore undesirable tool changes. In such a case it may be common sense, at least for the time being, to make the outside width of the box less than the preferred number. This would not result in any practical disadvantage, as the refrigerator could still be placed within the space provided for it. On the other hand, exceeding the preferred-number dimension should obviously be avoided. Cases of this kind often arise in practice with any standardization and each case has to be considered on its own merits.

Possible applications of preferred numbers as simple as those mentioned are numerous and a great deal could be accomplished even if preferred numbers were used only for such simple cases. There are, of course, also conditions where more or less complex interrelations of ratings or dimensions exist, making the application of preferred numbers somewhat more difficult. However, even then a solution can usually be worked out if common sense is used and the economical phases of the problem kept in mind.

Air conditioning one of the newest problems

THE standardization of cooling and compressor units for air conditioning by preferred numbers may be used to illustrate this. Units can be rated either in B.t.u.'s per hour or in tons of ice-melting capacity per 24 hours. While the use of B.t.u.'s would be more logical from a purely engineering point of view, it involves the use of rather large numbers and therefore there is a strong inclination toward the use of tons for commercial ratings. Since it may be rather hopeless to overcome this popular preference, especially as the majority of customers have no engineering training, it appears advisable to use tons as a basis for the commercial ratings.

It has already been established that a capacity of 1 ton for room coolers to be placed in a room under windows or elsewhere is a rather convenient size. It is, furthermore, a common practice to use two or three such coolers in one room, or a greater number of them for stores or a number of rooms and operate them from a single compressor unit. It is thus evident that a compressor rating (condensing unit) of 1.6 tons, for instance, as taken from the 5 series, would be of no practical use because it is too large for a 1-ton room cooler and too small for two of them. Similarly, a rating of 2.5 tons is too large for two such coolers and too small for three. It would, therefore, hardly be common sense to choose a series of compressor ratings for operating these room coolers by adhering blindly to either the 5 or the 10 series. The interrelation of the room coolers must obviously be considered.

The compressors are used not only with 1-ton room coolers but also in connection with cooling coils of larger capacities installed in the air ducts leading to the place to be air conditioned. Ratings for these larger cooling coils might be chosen as 2, 4 and 6.4 tons, which are numbers taken from the 10 series. At times some of these larger cooling coils and some of the 1-ton room coolers are served from a common compressor. With these practical conditions given, it requires but little study to see that compressor ratings of 1, 2, 4 and 6.4 tons, all of which are taken from the 10 series, are very satisfactory.

The following table gives all the combinations of coolers and compressors possible with these ratings:

Coolers Used	Tons	Compressor to be used	Coolers Used	Tons	Compressor to be used
6 1-ton	= 6	6.4	1 6.4-ton	= 6.4	6.4
5 1-ton	= 5	6.4	4 1-ton	= 4	4
4 1-ton and 1 2-ton	= 6	6.4	3 1-ton	= 3	4
3 1-ton and 1 2-ton	= 5	6.4	2 1-ton and 1 2-ton	= 4	4
2 1-ton and 2 2-ton	= 6	6.4	1 1-ton and 1 2-ton	= 3	4
2 1-ton and 1 4-ton	= 6	6.4	2 2-ton	= 4	4
1 1-ton and 1 4-ton	= 5	6.4	1 4-ton	= 4	4
6 1-ton	= 6	6.4			
3 2-ton	= 6	6.4	2 1-ton	= 2	2
1 2-ton and 1 4-ton	= 6	6.4	1 1-ton	= 1	1

Intermediate sizes when market justifies

It will be seen that of the eighteen combinations there are only three where the compressor has 25 per cent overcapacity. This, of course, could be avoided by additional compressor sizes, which, however, would not be economically justified under present conditions. The slight overcapacity of 0.4 tons where several coolers are connected to a 6.4-ton compressor is very desirable because in such cases there will by necessity be rather long pipe interconnections, resulting in certain losses. It is possible to select a good many other series of ratings from the 10 series, such as 1, 2, 3.2 and 5; however, this selection, although it has as many sizes as the one given previously, is not as suitable because it not only covers a smaller range but it also permits but a small number of combinations. The proper selection of ratings from preferred numbers in this and many other cases merely represents an engineering problem which has to be solved in the best manner possible under the conditions prevailing.

Following is a suggested more extensive line of compressor ratings:

Rating, tons:									
0.5	1	2	4	6.4	10	12.5	16	20	25
Approximate steps between ratings, per cent:									
100	100	100	60	60	60	25	25	25	

The 25 per cent steps suggested for the upper part of the series are desirable from an operating point of view. However, for the present the activity is not sufficient to justify so many compressor sizes all with different physical dimensions. It may, therefore, be found expedient to develop a 12.5-ton unit and operate it as a 10-ton or 16-ton unit, at lower and higher speeds respectively. Where there are belts or gear transmissions, this can easily be accomplished by changing the ratio. In the case of direct-

connected 60-cycle motors the same results may be accomplished by using an eight-pole motor for the 12.5-ton rating, a ten-pole motor for the 10-ton rating and a six-pole motor for the 16-ton rating. If it so happens that the 12.5-ton unit has six cylinders a 4-ton unit of the same speed, having two cylinders of the same size and design, could be devised. Similarly, a 6.4-ton unit can be obtained with this two-cylinder outfit by operating it with a six-pole motor. All such problems can be taken care of by a slight amount of ingenuity on the part of the manufacturer without necessitating his departing from the commercial ratings established by the proper use of preferred numbers.

Always easy to add or drop

THERE may also be need for additional ratings of room coolers as the time goes on. One 1-ton room cooler is not sufficient for a great many rooms and the installation of two such coolers is often unnecessarily expensive. On the other hand, with the present state of the art, a 2-ton room cooler would be too bulky. Therefore, it is quite likely that as business increases room coolers of 1.25 and 1.6-ton capacities will have to be developed. Smaller sizes also will be needed. In order to obtain the maximum combination possibilities, a ½-ton size might first be added to the line, and eventually the gap between the ½ and the 1-ton rating may be filled in by ratings of 0.64 and 0.8 ton.

The number of ratings economically justified is bound to change with the total activity and with the accumulation of experience, but if preferred numbers are always used for any new ratings established there will never be any great divergency between the line of one manufacturer and that of another and little difficulty will be encountered if at any time the trade associations should attempt a standardization of ratings.

The practice of having 100 per cent steps for part of the line, 60 per cent for another part and possibly 25 per cent for still another part, as indicated in the previously suggested line of compressors, is at times not only necessitated by the interrelations existing in the above case but is also justified by purely economical considerations. With a great many types of apparatus the labor content, which varies but little with the different sizes, is the predominant factor in the smaller sizes. As a result, the cost difference between the lower ratings is very small and therefore small steps in the ratings are not justified. In the larger ratings it frequently happens that the cost of the material content is predominant and thus will bring about appreciable changes in cost with changes in size; this, then, may justify the use of smaller steps in the higher ratings. There are a great many other factors entering into the choice of the size of steps, such as cost of tools, stock-keeping, performance, etc., which have been discussed more fully elsewhere.* Consequently, blind adherence to any one series for an entire line of apparatus, as is at times advocated by overenthusiasts on preferred numbers, is frequently not only inadvisable but in many case is contrary to common sense and economic considerations.

However, a judicious and advantageous selection of preferred numbers from the different series is nearly always possible because, fortunately, the system is so flexible as to care for most situations.

As already indicated, the standard 5, 10, 20 and 40 series permit steps of approximately 60, 25, 12 and 6 per cent respectively; in addition, other steps may be obtained as follows:

Per Cent Steps	Number to Use	Series
18	Every third	40
40	Every third	20
100	Every third	10
150	Every second	5
300	Every third	5

With some devices it may appear desirable to use preferred numbers for a variety of purposes, such as ratings, speeds, volume weights, over-all dimensions, certain basic internal dimensions, dimensions of standard parts, etc. Frequently the interrelations of such factors will create numerous problems. For example, with the standardization of a container for some purpose or other, the cubical content and two of the dimensions may be preferred numbers, but then the third dimension and the weight of the material which is held by the container probably cannot be preferred numbers on account of the definite interrelation between these various factors. If the particular material is commonly sold on a volume basis it is advisable to apply the preferred numbers to the volume; if it is sold on a weight basis they should be applied to the weight, but if it is sold by either volume or weight the more common practice may have to be favored. All such questions must be decided dependent upon the merits of the individual case and no general rule can be formulated which will relieve the designer of the responsibility of analyzing the factors involved and selecting the most advantageous compromise for the solution of the problem at hand.

In conclusion, it cannot be emphasized too strongly that preferred numbers should be used very extensively, but that considerations of utility, economics and, above all, common sense should govern their application to a great extent. In most cases the use of these numbers is an extremely simple procedure, and even where matters are somewhat involved it is usually not very difficult to find advantageous applications of the system.

Preferred Numbers as Exemplified in Preliminary A.S.A. Standard

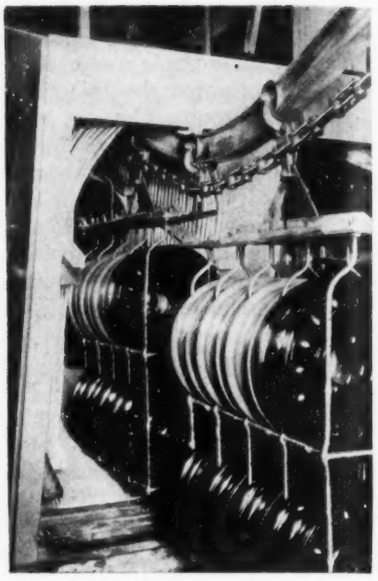
In general a number from the 5 series is preferable to one from the 10 series, a number from the 10 series is preferable to one from the 20 series, etc.

5 Series	10 Series	20 Series	40 Series	5 Series	10 Series	20 Series	40 Series
10	10	10	10	....	....	....	34
....	....	....	10.5	....	....	36	36
....	....	11.2	11.2	....	....	....	38
....	....	....	11.8	40	40	40	40
....	12.5	12.5	12.5	....	....	....	42.5
....	....	....	13.2	....	....	45	45
....	....	14	14	....	....	....	47.5
....	....	....	15	....	50	50	50
16	16	16	16	....	....	....	53
....	....	....	17	....	....	56	56
....	....	18	18	....	....	....	60
....	....	....	19	64	64	64	64
....	20	20	20	....	....	....	68
....	....	....	21	....	....	72	72
....	....	22.5	22.5	....	....	....	76
....	....	....	23.5	....	80	80	80
25	25	25	25	....	....	....	85
....	....	....	26.5	....	....	90	90
....	....	28	28	....	....	....	95
....	....	....	30	100	100	100	100
....	32	32	32				

Product Engineering, September and October, 1932; *Electrical Engineering*, January, 1932; *Commercial Standards Monthly*, May, 1932; *Zeitschrift des Vereines Deutscher Ingenieure*, July 22, 1933.

Enamel Baking by Induction Is Developing Rapidly

By EDGAR L. BAILEY
Electrical Engineer Chrysler Corporation, Detroit, Mich.



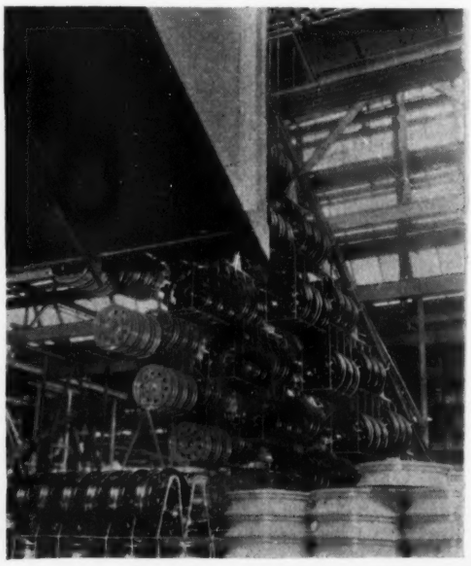
Scheme of oven for wheel enameling—This structure was built to show the principles of oven design to visitors who found the process all very mysterious. Within the approximately rectangular helix of conductor the wheels warm up under the hands of skeptics when the high frequency is applied

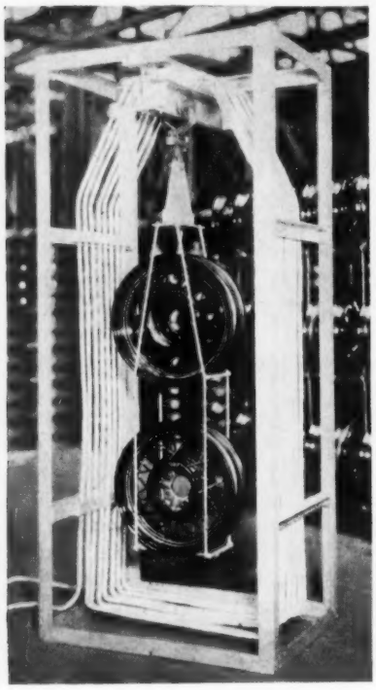
LAST year an induction oven of 10 kw. capacity for baking enamel on automobile parts was constructed and put into operation in the Plymouth plant of the Chrysler Corporation in Detroit. Today nine such ovens totaling 600 kw. are operating in the various Detroit plants of the corporation. The first oven* was, in a sense, experimental and was used for baking radiator shells. The succeeding ovens, developed from experience and data supplied by the first, are working on bodies, wheels, fenders and engine blocks.

The first design depended entirely for heat production on the work passing through the oven. This resulted in a heat gradient of about 75 deg. F. between the work and the air surrounding it in the oven. Experience and tests showed that this gradient was too steep, that better results were obtained when it was reduced to the neighborhood of 50 deg. F. Also, the first oven had no external magnetic shield and metals in close proximity to the oven walls showed an astonishing tendency to become uncomfortably warm. Accordingly, later designs included sheet iron oven housings, which not only eliminated stray fields but also improved the magnetic circuit and made the oven more efficient in actual use. The addition of the external shielding had also the desired effect on the air temperature in the oven; that is, the reduction in heat gradient between the work and surrounding air.

As explained in the earlier article, the outstanding characteristic of these ovens is that they operate at a frequency much lower than is usually considered necessary for induction heating. The fre-

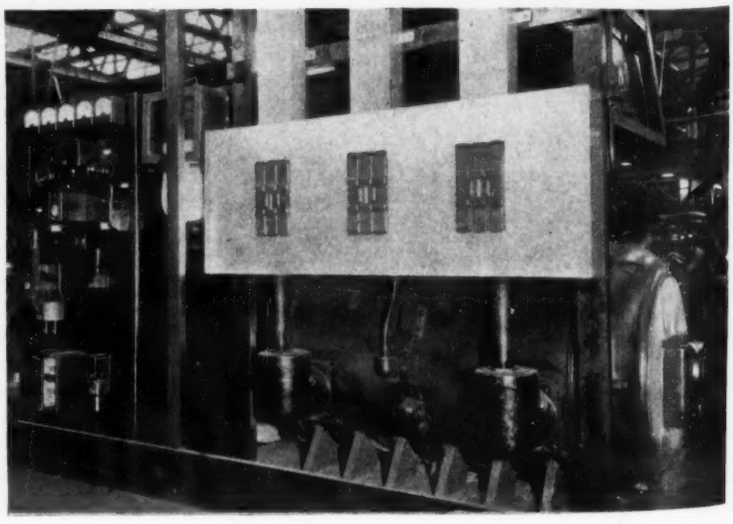
*"Low-Frequency Induction Oven for Baking Enamel," by Edgar L. Bailey, "Electrical World," December 2, 1933, page 727.





Production, 8,000 wheels per day—Entrance end of a 125-kw. wheel-enameling oven in Plymouth plant. Each carrier on the three oven conveyors holds six wheels, which move through the 100-ft. length of the oven at the rate of 1.8 ft. per minute

Energy supply—Induction frequency changer, 200 kw., supplying 360-cycle energy to wheel and radiation shell ovens at the Plymouth plant



Single conveyor wheel oven—Bakes on the decorative paint, striping, etc., on Chrysler and DeSoto wheels

Record of Operation, 125-Kw. Induction Oven

Plymouth Plant, for February, 1934

Wheels through oven	161,429
Energy used, kilowatt-hours	54,200
Energy per wheel, kilowatt-hours	0.3357

Low-Frequency Induction Ovens in Operation

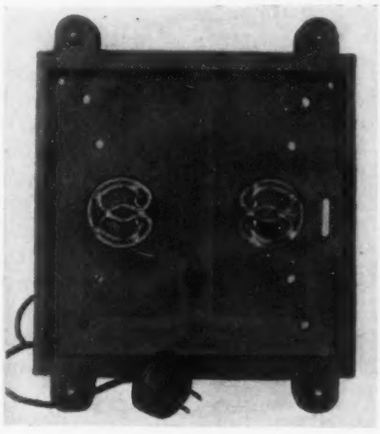
Chrysler Corporation, Detroit Plants

Location	Product	Oven Capacity, Kw.	Process
Chrysler-DeSoto, Jefferson Ave. plant	Wheels	85	Double coat synthetic enamel
Chrysler-DeSoto, Jefferson Ave. plant	Wheels	25	Decorative paint, strips, etc.
Chrysler-DeSoto, Jefferson Ave. plant	Sheet metal fenders, etc.	110	Six coats lacquer, one bake
Chrysler-DeSoto, Kercheval plant	Bodies	110	Parkalite
Chrysler-DeSoto, Kercheval plant	Bodies	100	Dry after water washing
Plymouth	Radiator shell	20	Lacquer
Plymouth	Radiator shell	10	Lacquer
Plymouth	Wheels	125	Double coat synthetic enamel
Plymouth	Engine blocks	25	Sealer coat
Total		600	

quency is only 360 cycles. Energy for all ovens in each plant is supplied from an induction type frequency changer. The oven power factor is extremely low and if not corrected would be reflected back into the 60-cycle supply. Therefore static condenser capacity sufficient for correction is installed at the 360-cycle circuits at the ovens so that the set operates at nearly unity power factor on both generator and motor ends.

Electric Heat Prevents Sticking of Molding Sand

When tempered foundry sand, somewhat warm, is packed in around a cold steel pattern, such as is used in production casting, the molder is likely to be exasperated when he finds some of the sand sticking to the pattern as he withdraws it from the finished mold. This happens in the morning when the day's work starts and the patterns are cold and is caused by condensation of moisture out of the warm sand on the cooler mold surface.



Sand sticking to patterns abolished by electric heat

Obviously, the way to cure this trouble is to warm up the pattern before molds are taken from it and obviously also the handiest way to do it is by electric heat. At least that was the conclusion in the Chicago plant of the Crane Company. Experimentally, a couple of flat percolator heating usings were inset in the jig in which the pattern is held as the mold is made. They worked beautifully and the pattern came away from the molded sand slick and clean. In the application of the idea to large numbers of molding equipments that followed the successful trial there came certain changes and developments that resulted in the design shown in the illustration. Here are two 400-watt heaters of the swaged tube type formed to fit into the flat wells of the pattern jig.

How Philadelphia Drives on Ranges, Water Heaters

Philadelphia has recently launched co-operative campaigns to promote electric ranges and electric water heaters, sponsored by the local Electrical Association. The electric range campaign, starting June 18, runs to December 24 in the territory embraced by the city of Philadelphia and the surrounding counties of Bucks, Montgomery, Chester and Delaware. Estate, General Electric, Graybar-Crawford, Hotpoint, L. & H., Monarch, Quality, Superior, Universal and Westinghouse ranges are being featured.

Ranges are being sold on a minimum down payment of $2 and a maximum of 36 months in the term of contract. A carrying charge of 2 per cent plus one-half of 1 per cent per month for the unpaid balance is being added to the cost of the range. The Philadelphia Electric Company assumes the cost of installing ranges on the first floor of any residence and makes a comparable allowance where the installation is on an upper floor. This enables the dealer to quote a flat price on ranges, which includes installation.

The campaign is being supported by an elaborate program of newspaper and billboard advertising, sales literature and cooking schools. Dealer salesmen receive special training from the association and the guidance of field managers, home economists and a practical sales manual. Prize contests are rewarding the most successful dealers in each territory. The campaign will wind up with a victory dinner, to which every dealer who sells one or more ranges or water heaters may attend and bring a guest.

The water heater campaign, running over three months beginning June 26, offers a three-month trial rental period. Customers may secure heaters from the Philadelphia Electric Company or any authorized dealer. Fifty and 80-gal. heaters are available. The 50-gal. heaters are sold for $75, the 80-gal. heaters for $100.

The customer makes a $10 down payment, to be refunded when the heater has been in use twelve months.

For the first six months there is a charge of 75 cents per month and $1 per month thereafter. The customer may purchase the heater and secure credit for all monthly payments and for the deposit if the purchase is made during the first twelve months.

Any authorized electric dealer who secures a trial agreement is paid $5.50 by the Philadelphia Electric Company and $5 additional if the company succeeds in converting a trial into a sale. Any approved water heaters may be sold on these terms. To encourage the dealer to connect a range in his store the Philadelphia Electric Company reimburses the cost of installation at the rate of $2 for each range sold during the campaign to the total of $30.

Power on a Co-operative Basis

How Three Companies North of Boston Support Each Other's Resources by Interchange of Energy

NO MORE interesting chapter in the power development of New England can be cited than the story of energy supply to the so-called Tenney properties north of the city of Boston. The territory in general lies between the Boston Edison system and Cape Ann. It includes many important municipalities served by the retail central stations held in the North Boston Lighting Properties and a few comparatively small publicly owned systems in the main tied into the North Boston transmission lines. Malden, Everett, Revere, Salem, Beverly, Gloucester and other places receive their electrical supply from an energy pool operated by the Eastern Massachusetts Electric Company, a transmitting subsidiary of North Boston and interconnected with the Boston Edison Company on the south and so with the far-flung New England Power Company system. The Merrimac Valley properties of the Tenney group, serving the Haverhill-Newburyport districts, are not as yet effectively interconnected with the others. The facilities for interchange utilized in the supply of the inner suburban properties of the North Boston group afford a striking illustration of the advantages of system co-operation during recent times.

A good-sized book could be written about the electrical development of this area beginning with the war period. Pioneer work was done by Charles H. Tenney & Company many years ago in interconnecting the local utilities of this territory by a trunk transmission line extending from Revere through Malden to Salem, and later to Beverly and Gloucester. The most economical generating plant of the group is a tidewater steam station at Salem, and for years this was operated as the base load installation of the system, the smaller units at Malden, Revere and Beverly being run less and less as the load on Salem grew. Later an interconnection was made with the Boston Edison system to take advantage of its efficient generating facilities. Studies were made by the Tenney organization for a new steam plant at Salem, but this did not eventuate in the face of the development of the New England Power Association's system and facilities, with interconnections of increasing capacity between that group and the Boston Edison company. The power picture changed radically with the purchase in 1931 of the entire Tenney enterprise by the New England Power group and the release of a large amount of generating and transmission capacity by load reductions on all three systems due to the depression.

This story of the development of a practical co-operation between three power systems in a small, densely populated area is a fine example of the benefits that come from interconnection. It is a phase of modern utility management and operation too little understood by the public—and in the industry itself.

Results of New England Power acquisition of Tenney properties

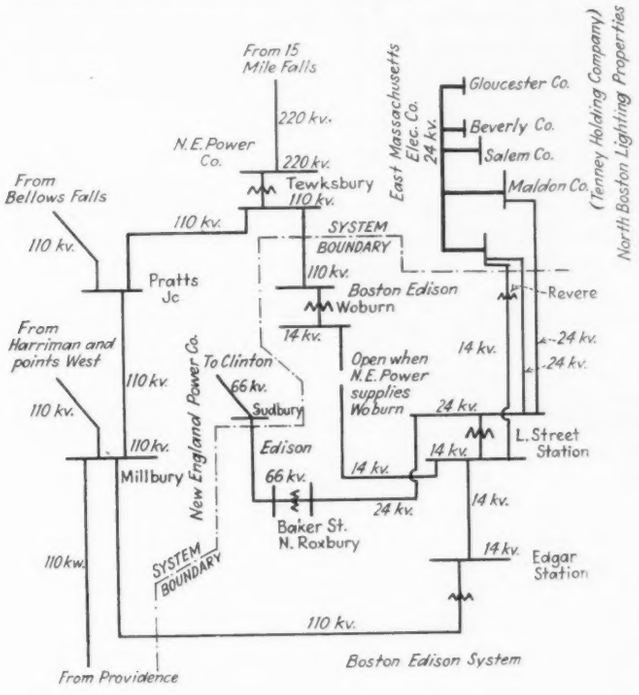
When the Tenney properties were acquired by New England Power much interest was aroused in engineering circles in regard to the future supply of the North Boston group. The air-line distance from Salem to New England's major receiving and transmitting substation at Tewksbury is around 15 miles and it appeared logical at first blush to build a tie line between the systems. The Edison company, however, had invested about $900,000 in transmission facilities to serve that portion of the Eastern Massachusetts company's load which could be handled more economically in this way than by the existing steam-generating equipment on the North Boston properties.

The existence of a large amount of idle capacity on the Edison system and frequent availability of extremely cheap energy on the New England system facilitated an agreement between the new owners of the Tenney organization and the Edison company for the still more effective use of interchange energy in supplying North Boston. It was accordingly decided to hold the construction of the Eastern Massachusetts-New England direct tie line in abeyance, and the three systems are operated to make use of the hydro resources of the interior of New England and points west along with steam plant and transmission facilities in eastern Massachusetts, to the mutual advantage of all concerned. Under present conditions this involves some roundabout interconnections, but the existence of unused capacity at various times enables the situation to be met effectively and conserves the investment already made in plants and lines throughout the entire eastern New England region.

Outline of present power facilities

The present power supply set-up for the North Boston properties, including the major interconnections between Eastern Massachusetts, Boston Edison and New England Power are indicated in the accompanying schematic, non-scalar diagram, greatly simplified for the purposes of this article. In brief, there is a two-circuit transmission trunk operating at approximately 24 kv. between the Salem steam plant of the Eastern system, Malden and Revere. The L Street steam plant of the

Schematic diagram of interchange facilities between the North Boston, Edison and New England Power systems



Data Relative to North Boston Supply

	1932	1931
Rating of Salem steam plant turbo-generators, kva...	34,375	34,375
Rating of Edgar steam plant turbo-generators, kva...	186,485	186,485
Rating of L Street steam plant turbo-generators, kva.	171,167	171,167
Transformer Capacity and Ties		
N. E. Power-Edison, 66-kv., Baker Street sub., kva.	24,000	24,000
N. E. Power-Edison, 110-kv., Millbury-Edgar, kva..	75,000	75,000
N. E. Power-Edison, 110-kv., Woburn sub., kva....	75,000	75,000
Eastern Massachusetts-Edison cable ties sizes (circ. mil)	2-350,000	2-350,000
	1-300,000	1-300,000
	1-No. 00	1-No. 00
N. E. Power-Edgar tie line, 2 circuits, copper.....	No. 4-0	No. 4-0
N. E. Power-Baker Street tie line, 1 circuit, copper..	No. 1-0	No. 1-0
Coal per kw.-hr. generated (based on D.P.U. return of fuel used and accounted for)		
Salem steam plant, lb.....	1.8	1.67
Edgar station (from D.P.U. case), approx. lb.....	0.95	0.95
L Street station (from D.P.U. case), approx. lb.....	1.2	1.2
Energy Data	—Kilowatt-Hours—	
Generated at Salem steam plant.....	52,519,800	124,936,100
Total purchased by Eastern Mass. Co.....	120,372,910	116,101,678
Purchased by Eastern Mass.		
From Salem Electric Lighting Co.....	16,330,500	80,002,000
From New England Power Co.....	87,711,500	8,570,000
From Boston Edison "N" rate.....	16,253,500	21,073,000
Energy Prices and/or Costs (Averages)	Mills per Kilowatt-Hour	
Salem generating cost excluding charges.....	8.9	6.43
Eastern Mass. Co. paid		
New England Power Co.....	4.18	4.0
Salem Electric Lighting Co.....	22.00	8.8
Boston Edison "N" rate.....	8.74	8.72
For all energy received, all sources, and delivered to system.....	7.25	8.35
Saving to Eastern Mass. Co. over 1931.....	1.10	....
Saving to Eastern Mass. Co. over 1931 when applied to 1932 volume of energy purchased, vs. 1931 costs....	Total Dollars $132,410	

NOTE: Metering points for N. E. Power-Boston Edison ties are at Millbury, Woburn and Sudbury; for Eastern Massachusetts-Boston Edison billing, at Malden and Revere.

Above data are representative unit costs as per slide rule computations; figures mainly from returns to Massachusetts Department of Public Utilities and testimony by Edison company in rate proceedings now pending. In round figures, Eastern Massachusetts, by purchasing interchange energy when available on off-peak and freshet power bases from Edison and New England systems (delivered through Edison) at vicinity of 4 mills per kilowatt-hour almost cut average unit energy cost in half.

Boston Edison company is connected with the Eastern system at Revere by two 24-kv. circuits and one 13.8-kv. circuit, and with Malden by a 24-kv. cable. The L Street plant in South Boston is connected with the Edgar steam station of the Edison company at Weymouth by 14-kv. cables. From L Street two 24-kv. circuits terminate at West Roxbury, where they are connected with transformers raising the potential to 66 kv. and serving a single-circuit line tying into the New England Power Company system by way of Sudbury and Clinton. This is the original high-tension interconnection between Edison and New England, set up as a war measure, having a capacity of about 20,000 kw., and still utilized for interchange and local supply on the western side of the Edison system.

From Edgar station two 110-kv. circuits run through Walpole and Medway to the operating center of the New England Power system at Millbury. Transformers aggregating 75,000 kva. step up the voltage at Edgar station from 14 kv. (generating potential) to 110 kv. From Millbury two 110-kv. circuits run through the outskirts of Worcester to Tewksbury via Pratts Junction. At Tewksbury two 220-kv. circuits are brought in from the Comerford station at Fifteen-Mile Falls, the energy being stepped down to 110 kv. and retransmitted at that voltage to the Woburn substation of the Boston Edison company. Thus a double 110-kv. line loops from Edgar station on the southeast to Woburn on the northwest. Transmission lines feeding the New England Power Company system at Millbury and Pratts Junction bring energy into service from the Providence district, Deerfield and mid-Connecticut Valley plants, in addition to generating facilities available at times from subsidiary central-station steam plants and industrial concerns served by New England Power. The Harriman-Millbury line is connected with the Connecticut Valley Power Exchange at the Cabot station of the Western Massachusetts Companies' system near Greenfield, and further west connections are made with transmission systems in New York State.

Edison feeders energized at 14 kv. extend from L Street station to Woburn and are closed in case the supply from Tewksbury is cut off, but when New England Power is feeding into Woburn the L Street lines are opened and the northern area of the Edison system, including Arlington, Woburn, Lexington, Concord and other communities, is carried by New England energy. It is intended later to provide phase-angle corrective equipment at Woburn to permit operating the entire Edison-New England Power transmission ties as a ring system.

The North Boston area, then, can be supplied with electricity generated at its own stations and/or delivered from the Edison system. The arrangements under which this supply now takes place may now be outlined.

Agreements for energy supply

Space will not permit an extended account of the interconnection agreements bearing upon the supply of the North Boston area, but a brief outline is of engineering interest. In 1917 an agreement was made between the Edison company and the New England Power Company relative to the disposition of energy generated at the Sudbury hydro-electric station of the Metropolitan Water Board, and both companies were tied into this station and interconnected on a small scale through the

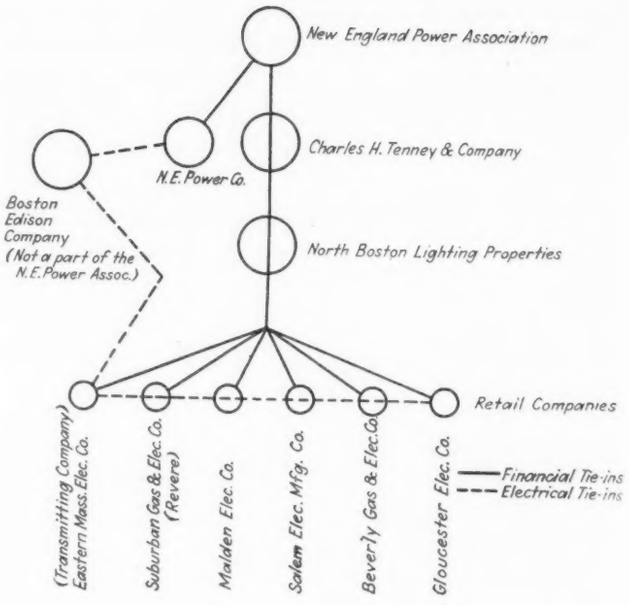
Edison feeders serving the region in and about Framingham. In 1918 a contract was executed between the two companies providing for the construction of the 66-kv. tie line from West Roxbury to Sudbury (and the 24-kv. line from L Street to West Roxbury), to facilitate interchange of energy as a war measure and provide improved service on the west of Boston. Two years later the presidents of the two companies agreed in writing to help each other out whenever feasible under emergency conditions facilitating interchange, and gradually Edison began to absorb more surplus hydro-electric energy from New England, New England buying from Edison during periods of low water supply.

Increase of economies

EDISON began to furnish energy on a small scale to Eastern Massachusetts Electric Company in 1919; this increased from time to time until about seven years ago, when substantial amounts were taken by the North Boston system under the so-called Edison "N" rate, providing for off-peak supply at comparable prices. The Salem steam plant continued to operate as the principal generating source on the Tenney system. The Edgar station was built in 1925 and soon achieved striking economies in production, operating for considerable periods at 1 lb. of coal or slightly less per kilowatt-hour. Salem was modernized and rendered excellent service, producing energy in 1931 for 1.67 lb. per kilowatt-hour, and at a manufacturing cost of 6.43 mills, excluding fixed charges, the plant rating being 34,375 kva. and its 1931 peak 27,000 kw. The high efficiency of the Edgar station and presence of surplus hydro on the New England system made it desirable for Eastern Massachusetts to purchase increasing amounts of energy, which it did.

On October 1, 1930, the Fifteen-Mile Falls (Comerford) plant of the New England Power system went into operation, and coincidently a twenty-year firm power contract between Edison and New England began to function in energy delivery. Under the terms of this contract (dated December 21, 1928) the Edison company agreed to take after the first year 150,000,000 kw.-hr. annually from New England on a 2,000-hour basis, the annual price totaling $2,025,000, or 13.5 mills per kilowatt-hour. (Periodic price revision was provided in the agreement.) Other energy purchased from New England falls under the classification of interchange power, with prices determined by the operating departments of the two companies at the time of taking. This contract, providing for the delivery of this substantial amount of energy to Edison, was entered into at a time when business was growing rapidly. It enabled the Edison company to postpone indefinitely the enlargement of its Edgar station and has also postponed the construction of generating plant facilities on a site owned by the company in Everett, on the waterfront of Boston. New England's delivery under this contract to Edison under the depressed conditions of business which prevailed released generating and transmission capacity owned by Edison for service to Eastern Massachusetts and other users, but until the acquisition of the Tenney organization of New England Power the full possibilities of interchange were not exploited.

It is of interest to note that no interchange contract exists between the Edison and New England Power companies, the handling of energy of that class being


New England Power Association
Charles H. Tenney & Company
N.E. Power Co.
Boston Edison Company (Not a part of the N.E. Power Assoc.)
North Boston Lighting Properties
Retail Companies
(Transmitting Company) Eastern Mass. Elec. Co.
Suburban Gas & Elec. Co. (Revere)
Malden Elec. Co.
Salem Elec. Mfg. Co.
Beverly Gas & Elec. Co.
Gloucester Elec. Co.
Financial Tie-ins
Electrical Tie-ins

Financial control of North Boston properties

based on hour-to-hour co-operation, with prices determined by the respective increment costs of the two companies and savings divided between the participants on an even basis. Primary power is taken in general on the 2,000-hour basis as above provided.

Interchange power for North Boston

In November, 1932, after a trial, an agreement was ratified between the Edison and New England companies under which the North Boston properties acquired from Tenney in 1931 should be further supplied with interchange energy via the Edison system. Delivery to North Boston under the "N" rate ceased as of November 1, 1932. The agreement was written for one year and has some extremely interesting features. Under it Edison and New England jointly arrange for the supply of power to this territory. Interchange power is defined as electricity produced from the spare capacity of one system and transferred to another at prices determined from a consideration of increment costs. Increment cost is defined by the two companies as the amount by which the total cost of producing a given amount of electrical energy measured in kilowatt-hours is exceeded by the total cost of producing a larger amount of energy. The unit increment cost is the excess cost per additional kilowatt-hour. Costs depending upon investment are not involved unless new investments are required to produce the additional kilowatt-hours. The term may also be used negatively, or in the sense of "decrement" power, this being the cost saved by producing fewer kilowatt-hours than the given amount. "Freshet electricity" is defined as that available on the system from hydro-electric resources in excess of the system requirements, as a result of run-off caused by rain or melting snow.

Under the firm power contract between Edison and New England (1930-1950), Edison has the right to take 75,000 kw., of which 25,000 kw. may be taken at Millbury when New England Power has spare transmission capacity. Edison may increase its taking at Millbury up to the available spare capacity of New England's lines

and equipment to such extent that after taking the requirements of its Woburn district it may take the balance of the 75,000 kw. at Millbury.

New England Power agreed to purchase from Edison interchange power to be delivered to its subsidiary North Boston properties (Eastern Massachusetts system) for New England's account over the existing lines to Malden and Revere substations. The amount of this power is that in excess of such generation as North Boston may consider necessary for service protection. Such generation is supplied almost entirely by the Salem station. Payment for this interchange power delivered by Edison to North Boston is arrived at between the dispatching departments of Edison and New England on the same basis as for interchange already being handled between these two companies, except with certain fixed charge considerations (taking account of the cost of interconnecting the North Boston properties with New England Power by direct tie line to the Tewksbury district or vicinity and an amount relative to Edison's investment to serve North Boston agreed upon by the parties as fair). Edison's increment cost is deemed as 3.1 mills per kilowatt-hour and North Boston's (at Malden and Revere) at 3.9 mills for the above purpose. The saving of 0.8 mill is halved by Edison and New England (as owner of the Tenney interest) in supplying North Boston on this co-operative basis, giving each company 4 mills per kilowatt-hour. In 1932 North Boston's total purchase of "interchange" power aggregated 80,768,300 kw.-hr., for which New England Power was billed by Edison 3.4 mills per kilowatt-hour (approximate). North Boston purchased from Salem in that year 16,330,500 kw.-hr. at an average cost of 2.2 cents per kilowatt-hour. She also bought 16,253,500 kw.-hr. from Edison on the "N" rate (off-peak) at about 8.74 mills per kilowatt-hour, and besides buying very small blocks of energy from other sources bought 5,594,200 kw.-hr. of freshet power from New England through the Boston Edison system, for which the latter received about 1.25 mills per kilowatt-hour for transferring it.

This last item is interesting as an equivalent cross-system transaction in which available freshet power on the New England hydro system is utilized for the benefit of North Boston, with Edison acting as a transfer agent. The circuit distance from Millbury to Malden is about 65 miles and from Millbury to Revere about 68 miles. It is apparent that little or no actual transfer of identical energy occurs from Millbury to North Boston, but the results are equivalent. The agreement states that when New England has freshet power available Edison will transfer such power from the New England lines to North Boston to such extent as Edison has spare transmission capacity available. For such power furnished Edison for delivery in kind to North Boston, New England does not bill Edison, but bills North Boston direct. Edison bills New England for the transfer of such power an amount equal to the usual one-third of the savings effected by the transfer, as in similar interchange transactions (the one-third being due to the participation of three companies).

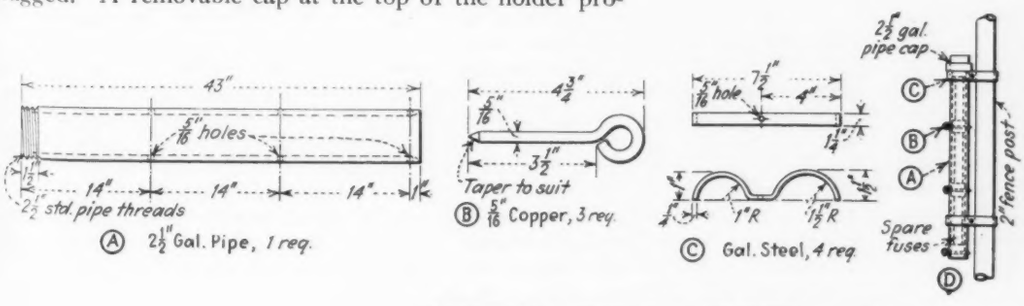
Edison agreed to supply power to North Boston under the interchange plan so far as required by the Eastern Massachusetts system over and above its own generation, taking into account service protection and the differential between production costs at the Salem station and at the Edison plants. In the event of equipment failure so that Edison lacks the required capacity at the time in question, New England Power will at Edison's request deliver to the Edison system an amount of energy equivalent to such needs. This delivery is handled on the basis above outlined for freshet power pricing. This insures North Boston emergency service with both Edison and New England systems co-operating.

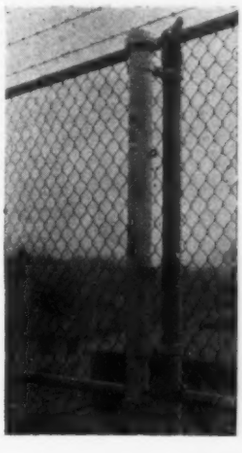
Summing up the development of North Boston's power supply facilities to the present time, the co-operation of the three companies enables the territory to take advantage of existing steam plant capacity, of spare transmission capacity, of surplus generating plant facilities, whether steam or hydro, and to utilize the established investment effectively. The purchase of interchange energy by Eastern Massachusetts at favorable prices resulted in a reduced taking from the Salem station (from 80,002,000 kw.-hr. in 1931 to 16,330,500 kw.-hr. in 1932). The local load of the Salem Electric Lighting Company, however, was served by this plant in addition to its deliveries to Eastern Massachusetts.

The over-all benefits of the interchange were reflected in the average cost of energy delivered from all sources to the Eastern Massachusetts company's buses. This fell from 8.35 mills in 1931 to 7.25 mills in 1932 and represented a saving of $132,000 on the 1932 volume of energy handled by the Eastern Massachusetts lines.

Spare Fuse Holders

To prevent mechanical injury to spare fuses used in high-tension substation operation the Blackstone Valley Gas & Electric Company has designed a standard holder which is readily clamped to a pipe frame carrying the substation wire fence and which is weatherproof and rugged. A removable cap at the top of the holder protects the stored fuse from damage due to external conditions.





LETTERS TO THE EDITOR

Fair Play in Accounting

To the Editor of the ELECTRICAL WORLD:

The article on depreciation accounting in your issue of July 14 clearly indicates that the writer did not read my argument carefully or with an open mind and it is to be regretted that he has allowed himself to sound the personal note in a general discussion. I did not label my "opponents" as "economists who are able writers, but absolutely without practical operating experience." What I did say was: "The depreciation method of accounting, possibly because of its complexity, evidently appeals strongly to economists who are able writers, but absolutely without practical operating experience," which carries an entirely different implication. I am inclined to feel that Mr. Thompson has very ably proved my case. His point regarding the practical knowledge of an investment analyst is well taken, but, as it happens, this particular analyst may reasonably claim such knowledge by virtue of thirty years experience in the active management of public utilities.

Regarding the weird insinuation that I am a partisan "in disguise" for a special interest (sinister appellation) I admit freely that I am very much interested in helping to secure a fair deal, no more is desired, for an industry with which I have been identified almost from its inception and in which so many individuals, educational institutions, savings banks and life insurance companies, including the company with which I am now associated, have a very vital financial interest. In this connection it may be well to add that I am not now interested in or connected, directly or indirectly, in any way with any public utility or the operators of any public utility, excepting through my responsibility for investments of a life insurance company.

Mr. Thompson's arguments, or rather assertions, with their implied hostility to the public utilities (special interests) do not cast any additional light on the subject and are answered, almost without exception, in my recent article, which was not intended to be of a controversial nature and was not written as a partisan of the utilities, but rather in the light of my past eight years experience in studying the public utility situation from the view-point of an investor of trust funds. One point only, which I have not previously discussed, should receive present attention. Mr. Thompson, in common with other writers, attributes the losses of investors in electric railways to inadequate depreciation allowance, which is a palpable error. These losses, as I can state from sad experience, were not due to physical depreciation, but rather to changes in social conditions, mainly the result of the advent of the automobile. No form of depreciation or retirement accounting could have saved the investors from loss in that emergency, which was one of the "ordinary hazards of business" to which I referred; in fact, I had the electric railways in mind when I wrote that sentence.

E. P. COLEMAN.

National Life Insurance Company,
Montpelier, Vermont.

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Better Reasons for Aluminum Choice

To the Editor of the ELECTRICAL WORLD:

Our attention has been called to a brief item in the ELECTRICAL WORLD for July 14, to the effect that Germany has adopted aluminum cable in place of copper. This item, which appears on page 61, closes with a sentence which creates an erroneous impression.

While it is true that in the case of copper all the raw material must be imported, whereas only bauxite must be brought in to produce aluminum, the real reasons for this designated preference for aluminum are the facts that its production means more labor for the German people, it keeps busy the capital invested in German aluminum plants and it coincides with the German policy of encouraging industries which will be useful in time of war.

There is, of course, the additional reason that the present trend is toward aluminum for high-voltage transmission lines. As a matter of fact, 80 per cent of the high-voltage transmission lines in this country and Canada are aluminum cable steel reinforced.

C. C. CARR.

Aluminum Company of America,
Pittsburgh, Pa.

BOOK REVIEWS

First Aid for the Ailing House

By Roger B. Whitman. Published by Whittlesey House, 330 West 42d St., New York. 304 pages, illustrated. Price, $2.

Practical kinks about heating, plumbing, painting, windows, floors, woodwork, roofs, cellars and insect control are here aplenty to help the home owner keep his property in trim. But one would think the book had been written for Labrador or for Colonial days. All mention of the electrical aspects of the home is confined to five fine-print sentences under "suggestions for repairs." Thousands of homes are ailing today because they are wired and lighted inadequately, obsoletely or even hazardously. A book on "ailing homes" has no claim to completeness when it ignores the failure of these homes to gear themselves to the electrical age, no matter how helpful it may be in other directions. Subsequent editions should correct this glaring weakness.

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Logarithms—Numerical and Graphical

By N. R. Corke. Published by Gee & Company, Ltd., 6 Kirby Street, London, E.C. 1, England. 79 pages, illustrated. Price, 8/6 net.

To make logarithms appeal more as a simple, accurate and practical way to calculate is the objective here. It is in self-help style, shows the rudiments of logarithms in both the tabular and slide-rule form, as well as discussing logarithmic plots on co-ordinate paper. There is a good chapter on the construction of nomograms. Tables in the appendix are four-place.

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Elektrische Schaltvorgaenge

(Switching Phenomena and Related Disturbances in Electric Power Systems)

By R. Rüdenberg. Published by Julius Springer, Berlin W.9. 634 pages, 821 illustrations. Price 42.00 reichsmarks.

Electrical engineers concerned with the operation of large power systems will find much to interest them in this comprehensive analysis of disturbances —provided, of course, that they have the necessary linguistic equipment. The present third edition, according to the preface, has been considerably expanded from the first, which was published ten years ago. Any worth-while treatment of transient phenomena must, of necessity, be mathematical, but the author writes as an engineer and not as a mathematician. On only a few occasions is the domain of ordinary calculus transcended, as for example in the section on earth currents, where reference is made to Bessel's functions. Theory is used as a means for arriving at conclusions having physical significance.

The first section deals with the relatively slow changes in closed circuits as they exist in various types of electrical machines; it takes in such topics as the effect of rotating masses, the pumping of synchronous machines, the influence of the earth. The middle section is a study of circuits, electric and magnetic, with non-linear characteristics. The last third of the book is devoted to traveling waves and related phenomena.

Commendable features are: Clear treatment, copious and well-executed diagrams, excellent typography, 25 pages of bibliography and a good index. Dr. Rüdenberg is chief electrical engineer of Siemens-Schuckertwerke.

NEWS OF THE WEEK

Alabama Power Stockholders Urge Ban on T.V.A. Contracts

Holders of preferred stock fight sale of lands and systems—Authority's power output fully sold—Knoxville approves T.V.A. plan—Atlanta takes action

IN A letter addressed to the president and board of directors of the Alabama Power Company a group of preferred-stock holders has protested the activities of the Tennessee Valley Authority, its contracts with the Alabama Power Company and contracts between the company and the Electric Home and Farm Authority, Inc. Signatories of the letter include R. H. Woodrow, president and director of the Birmingham Ice & Cold Storage Company, the Rushton Corporation, the Alabama Ice Company and an officer and director of other corporations and banking institutions, and H. L. Morrow, treasurer and director of the Alabama By-Products Corporation and the Hammond Iron Company, both of Birmingham.

The companies headed by Mr. Woodrow are among a large group of Southern ice companies which, together with coal interests from many Southern states, brought separate actions in equity before the United States District Court for the Southern Division of the northern district of Alabama against the T.V.A. and other defendants, asking that they be restrained from selling electrical refrigerating appliances through the use of public funds on credit and from engaging in the business of a distributing utility.

Stockholders urge action

After reciting their objections to the relations between the company and the Tennessee Valley Authority, the preferred-stock holders ask the officers and directors of the Alabama Power Company to take immediate steps by corporate action and suit (1) to annul the alleged contract dated January 4, 1934, and the amendment thereof dated February 13, 1934, between Alabama Power Company and others with T.V.A., in so far as Alabama Power Company is concerned; (2) to terminate performance in any respect of that contract and to refrain from executing and delivering to T.V.A. the transmission lines, utility properties and lands proposed to be transferred as set out in the proceeding heretofore pending before the state commission; (3) to refrain from further transactions with or conveyances to T.V.A. looking to or relating to the latter's use or acquisition of properties or systems of Alabama Power Company for the purpose of engaging in the operation of a utility in Alabama within the area now served by Alabama Power Company; (4) to refrain from any transaction with or conveyance to the T.V.A. tending to effectuate on its part a departure from the federal Constitution or a violation of the laws of Alabama relating to the qualification of utilities, the effect of which would be to further the T.V.A. program of creating and marketing power as a utility or otherwise; (5) to terminate its agency contract and relations with T.V.A.'s acknowledged agency, the so-called Electric Home and Farm Authority, Inc.

Request to void T.V.A. act

"In particular," the leter continues, "we respectfully insist that Alabama Power Company file suit immediately against T.V.A. and its directors and agents to declare unconstitutional and void the Tennessee Valley Authority act; to enjoin and restrain T.V.A., its agents and agencies from the construction of hydroelectric plants with a view to the proprietary sale of the energy to be produced by such plants for distribution or consumption in the state of Alabama; to enjoin these agencies from using public funds to further their program of unlawful competition with Alabama Power Company or to make effective further acts of duress toward Alabama Power Company . . ."

The Tennessee Valley Authority has sold its entire existing electric capacity and construction work on its two new dams is proceeding ahead of schedule, David E. Lilienthal, T.V.A. official, declared this week before sailing for England and Ireland to study government electric development projects in those countries. While not all of the existing capacity is actually in use, Mr. Lilienthal said, all of the current from the Wilson Dam is either sold or allocated under contracts now negotiated. As an indication of how the lower rates of the authority are fostering the use of electricity, Mr. Lilienthal cited an 83 per cent increase in domestic use of electricity in Tupelo, Miss. The work on Norris Dam is proceeding better than scheduled, both in time and in unit costs, he said.

Atlanta recently moved to obtain electric power from the authority when Mayor James L. Key received a resolution, passed by City Council, to investigate the feasibility of a contract between the city and T.V.A.

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Sampsell Set Free in Embezzlement Case

"Not guilty" verdict returned by jury for Central Illinois executive. Insull, Jr., and three others indicted in Indiana.

Verdict of not guilty was returned this week in the case of Marshall E. Sampsell, formerly president of the Central Illinois Public Service Company, an Insull subsidiary, who was charged with embezzling 4,000 shares of the company's stock from its treasury. Assistant State's Attorney John O'Hara had characterized the defendant as a "pirate of industry." He asked that Mr. Sampsell be convicted and sent to the penitentiary for one to ten years, the statutory penalty for embezzlement. The defense attorney, Charles Lounsbury, begged the jury not to let Mr. Sampsell be sacrificed as a sop to the public indignation over the depression and financial failures growing out of it. The defense won a point when Judge Michael Feinberg agreed to instruct the jury that if Mr. Sampsell was honestly mistaken in his right to take the stock from the company's treasury, he could have had no criminal intent as defined by the statutes. The evidence showed the stock was pledged as collateral for company loans.

Indiana indictments

Samuel Insull, Jr., formerly vice-chairman of the board of the Northern Indiana Public Service Company, and three former associates were charged with embezzlement and grand larceny from the company in an indictment returned this week by the grand jury of Lake County, Indiana. Bonds were fixed at $10,000 each. Named with Mr. Insull, Jr., were Morse Dell Plain of Hammond, president of the company; Bernard P. Shearon of Chicago, treasurer and director, and Edward Lloyd of Chicago, a former director.

Maintaining that by trying the Insull mail-fraud conspiracy case piecemeal an opportunity would be presented to shift the blame to "less culpable" defendants, the government has filed a memorandum in federal court in Chicago requesting that Samuel Insull's petition for a separate trial be denied.

A.I.E.E. Committees Formed for 1934-1935 Activities

J. Allen Johnson, president of the American Institute of Electrical Engineers, has announced the following appointments to the chairmanship of major committees for the administrative year beginning August 1, 1934:

Executive—J. Allen Johnson, president of the institute.

Board of Examiners—W. R. Smith, United Engineers & Constructors, Inc.

Code of Principles of Professional Conduct—C. E. Stephens, Westinghouse Electric & Manufacturing Company.

Constitution and By-Laws—E. B. Meyer, United Engineers & Constructors, Inc.

Co-ordination of Institute Activities—L. W. W. Morrow, ELECTRICAL WORLD.

Economic Status of the Engineer—C. O. Bickelhaupt, American Telephone & Telegraph Company.

Finance—R. H. Tapscott, New York Edison Company.

Institute Policy—H. P. Charlesworth, American Telephone & Telegraph Company.

Legislation Affecting the Engineering Profession—W. I. Slichter, Columbia University.

Award of Institute Prizes—R. N. Conwell, Public Service Electric & Gas Company.

Technical committees

Automatic Stations—M. E. Reagan, Westinghouse Electric & Manufacturing Company.*

Communication—H. M. Turner, Yale University.

Education—L. A. Doggett, Pennsylvania State College.

Electrical Machinery—V. M. Montsinger, General Electric Company.

Electrochemistry and Electrometallurgy—N. R. Stansel, General Electric Company.

Electrophysics—W. F. Davidson, Brooklyn Edison Company.*

Instruments and Measurements—W. B. Kouwenhoven, Johns Hopkins University.

Applications to Iron and Steel Production—R. W. Graham, Bethlehem Steel Company.

Production and Application of Light—J. W. Barker, Columbia University.

Applications to Mining Work—L. C. Ilsley, U. S. Department of Commerce.

General Power Applications—M. R. Woodward, Babcock & Wilcox Company.*

Power Generation—H. W. Leitch, New York Edison Company.

Power Transmission and Distribution—D. M. Simmons, General Cable Corporation.

Protective Devices—H. P. Sleeper, Public Service Electric & Gas Company.

Research—F. M. Farmer, Electrical Testing Laboratories.

**Tentative—awaiting acceptance.*

COMING MEETINGS

International Association of Municipal Electricians — Wardman Park Hotel, Washington, D. C., August 29-Sept. 1. W. H. Harth, City Hall, Columbia, S. C.

Producers and Distributors of Electrical Energy—Fifth International Congress, Zurich and Lausanne, Switzerland, August 29-Sept. 7. Secretary, Union des Centrales Suisses d'Electricite, 301 Seefeldstrasse, Zurich.

American Institute of Electrical Engineers—Pacific Coast Convention, Salt Lake City, Utah, September 3-7. General Convention Committee, 1016 Continental Bank Bldg. Salt Lake City, Utah.

Rocky Mountain Electrical Association—Annual convention, Estes Park, Colo., September 10-12. G. E. Lewis, Managing Director, Gas & Electric Bldg., Denver, Colo.

Association of Iron and Steel Electrical Engineers—30th convention, held in conjunction with the Iron and Steel Exposition, Cleveland, Ohio, September 18-20. J. F. Kelly, Empire Bldg., Pittsburgh, Pa.

National Electrical Exposition — Madison Square Garden, New York, N. Y., September 19-29. Ralph Neumuller, Electrical Association of New York, Grand Central Palace, New York.

Electrochemical Society — Sixty-sixth convention, Hotel Pennsylvania, New York City, September 27-29. Colin G. Fink, Columbia University, New York.

Illuminating Engineering Society — Annual convention, Baltimore, Md., October 1-4. D. W. Atwater, Secretary, 29 West 39th Street, New York.

National Electrical Manufacturers Association—Annual meeting, Chicago, October 17-20. W. J. Donald, 155 East 44th St., New York.

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Labor Violation Charged to Pacific Gas

Charges of violating the president's re-employment agreement under the NRA were brought against the Pacific Gas & Electric Company by the San Francisco Regional Labor Board for discharging three Sacramento employees. In a decision concurred in by four members of the board, it is declared that the employees "were discriminated against and discharged primarily because of their activities in the International Brotherhood of Electrical Workers." The local officials of P. G. & E. were called before the regional labor board in Sacramento when the board reiterated a previous decision ordering the utility to reinstate the employees.

Maintaining that "there are no vacancies," the company has refused to rehire two of the employees who sought reinstatement. Following this action by the company J. L. R. Marsh, secretary of the Federated Trades Council, announced that he will demand federal prosecution of the company. Paul M. Downing, vice-president and general manager of the Pacific Gas & Electric Company, had denied that the men were discharged because of their union affiliations.

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N. Y. Inquiry Continues

Following passage by the New York State Legislature of the Dunnigan bill, designed to insure the continuance of the public utility investigating committee (ELECTRICAL WORLD, August 4, page 155), Governor Lehman signed the measure, which will give legal authorization to the joint legislative committee to sit after the adjournment of the present Legislature.

. . . THIS WEEK IN WASHINGTON

Bonneville Dam to be redesigned—Light and power code under discussion—Clyde Seavey arrives in Washington.

DETERMINATION of actual expenditures of applicants for rights on the Tennessee River and on the Santee and Cooper Rivers is to be undertaken by the Federal Power Commission. The Tennessee Valley Authority and the Public Service Authority of South Carolina have agreed to reimburse the applicants for out-of-pocket expenditures other than the promotional expenses involved.

An important change in the Bonneville Dam has been announced by the Secretary of War. The lock is to be increased 140 ft. in length and the depth over the sills increased 12 ft. As redesigned the lock will be 500 ft. long with a depth of 27 ft. at low water. This change adds $1,200,000 to the cost of the structure. The change was made so that the lock would be usable in the event the Columbia River project was increased to a prevailing depth of 30 ft.

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While President Roosevelt indicated prior to his departure for Hawaii that the electric light and power code was not satisfactory to him in certain particulars, the code was not returned. It is understood that Secretary Perkins of the Labor Department investigated labor provisions of the code during the President's absence. It is fully expected at the NRA, however, that objections can be ironed out and approval ultimately secured.

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Clyde L. Seavey arrived in Washington August 14 and has entered upon his duties as a member of the Federal Power Commission. Mr. Seavey has just concluded his work with the California Railroad Commission, of which he was president for six years.

PAUL WOOTON,
Washington Correspondent.

Electric Workers Join Cuban Strike

Electric power was cut off early this week in Havana, Cuba, when workers in the local power plant walked out in sympathy with the communications strike. No casualties were reported. The communications strike has tied up the capital, but the workers in the main have been orderly. President Carlos Mendieta, although seeking early settlement of the trouble, refused to receive a strikers' committee.

Coal Association Opposes National Water-Power Plan

Terming the administration's water-power development program as "social folly and economic waste," the National Coal Association in a pamphlet issued last week urged that it be halted. Existing power plants, the association maintains, can produce almost twice as much electricity as the nation consumes. The administration's program contemplates adding 19,000,000,000 kw.-hr. a year to the potential output and that addition would give the country facilities for turning out three times as much electricity as it now uses, the pamphlet states.

If completed, the program would be disastrous to the coal industry, the association maintains. "Every million tons of coal displaced in the Tennessee Valley or elsewhere would result in elimination of 20,000 carloads of coal, 400 trains of 50 cars each, and elimination of the employees required to operate them . . . in the loss of $1,000,000 annually in the pay envelopes of mine employees." The Tennessee Valley Authority program alone, the pamphlet said, called for hydro-electric plants capable of turning out 1,000,000 kilowatt-years of power annually. Each kilowatt-year represents six tons of coal.

The association also claimed electricity nearly always could be produced more cheaply by coal steam than by water power. "It is easy to talk about falling water power costing nothing—about great natural resources of water power waiting to be harnessed, but all this ignores the fact that the 'harnessing' costs fabulous sums. Couple modern efficiency of steam plants in producing electricity with an abundant supply of cheap coal and current losses of long-distance electric transmission and the steam plant is the most economical almost every time."

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Congress on Electricity Announces Program

Full program has been issued of the fifth congress of the International Union of Producers and Distributors of Electricity, which is to be held in Zurich, August 29-31, and continued in Lausanne on September 5 and 6, the intermediate days being devoted to visits to electric power stations and other places of electrical interest.

The work of the international congress will be divided into twelve groups, in each of which a large number of papers, emanating from electrical engineers in all the different Continental European countries, will be read. Among the reports will be one on "The Efficiency of Modern Steam Boilers," by M. H. Bres of the Union de l'Electricité, Paris; one on "Insulator Losses in Power Transmission Lines," by Signor Palestrino of the Societa Idroelettrica Piemonte, Italy, and one on "The Causes and Reduction of Noise in Urban Power Distribution Systems," by M. L. Astier and P. Baron of the Compagnie Parisienne de Distribution d'Electricité.

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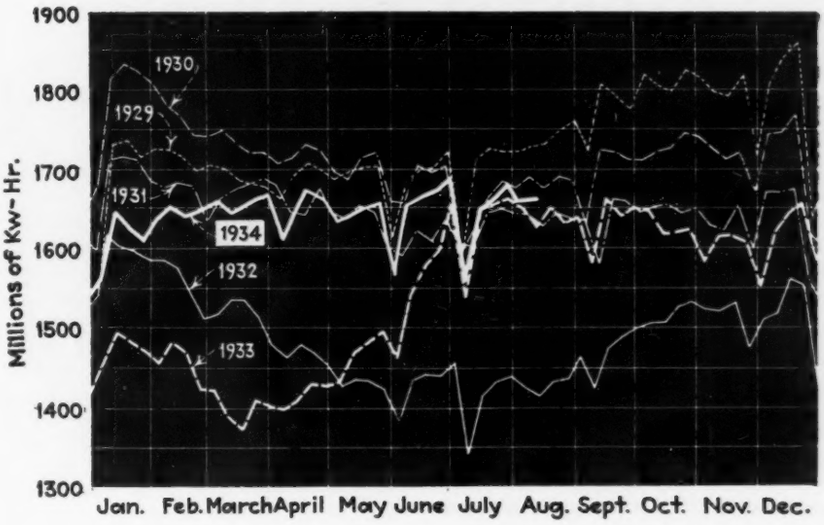
Canadian Diesel Engines

The first of four 600-hp. modern Diesel type engines for the new municipal electric plant of the city of St. Hyacinthe, Que., has been completed and tested at the plant of the Montreal Locomotive Works, Ltd. This is the first of such engines to be constructed in Canada with Canadian labor and has been hailed as an engineering achievement of historical importance.

Energy Output Holds Level



Electrical energy output is showing a tendency to maintain recent levels with no evidence either of a rise or decline. Reported by the Edison Electric Institute as 1,659,043,000 kw.-hr. for the week ended August 11, it rose by a negligible amount over the preceding week, but the gain over 1933 increased to 1.9 per cent. While the latter is the best figure since the end of June, the favorable showing is to be ascribed to a decline last year rather than to any present advance.

On the Pacific coast, where recent labor disturbances undoubtedly caused some reduction in energy consumption, the increase over 1933 again exceeded 8 per cent, approximately the same as in the week of August 4. In the Central industrial region the preceding week's deficiency of 2.6 per cent compared with 1933 was cut to 0.3 per cent. A similar but larger gap in New England has been gradually shrinking to a present disparity of less than 6 per cent. Production in the Middle Atlantic states rose 1.7 per cent above last year's figure. The largest regional gain, 11.5 per cent, was reported in the West Central area.

Weekly Output, Millions of Kw.-Hr.

1934	1933	1932
Aug. 11... 1,659	Aug. 12... 1,627	Aug. 13... 1,415
Aug. 4... 1,658	Aug. 5... 1,650	Aug. 6... 1,427
July 28... 1,684	July 29... 1,662	July 30... 1,440
July 21... 1,664	July 22... 1,654	July 23... 1,434
July 14... 1,648	July 15... 1,648	July 16... 1,416

Per Cent Change from Previous Year

Region	Week ended Aug. 11	Aug. 4	July 28
New England	— 5.9	— 8.6	— 7.1
Middle Atlantic	+ 1.7	+ 1.0	+ 1.7
Central Industrial	— 0.3	— 2.6	+ 0.2
West Central	+11.5	+ 9.7	+ 8.7
Southern States	+ 1.3	+ 1.7	+ 4.0
Rocky Mountain	— 3.7	— 1.5	— 3.0
Pacific Coast	+ 8.1	+ 8.2	+ 4.6
United States	+ 1.9	+ 0.5	+ 1.3

Galloway Plan Advancing

Work has now so far advanced on the Galloway hydro-electric project, Scotland, that it is anticipated that the first stage will be completed in about three months. It is calculated that the total cost of the undertaking will be £3,000,000 (more than $15,000,000), and about one-half of that sum has already been expended. The work has been undertaken in two stages, the first of which has involved the erection of two generating stations in the lower valley of the River Dee, one at Glenlee and the other at Tongland. The superstructures of both stations have been completed and the generating sets are being installed. In September or October next the plant will be under test, and shortly afterward a supply of electric current will be given over a wide area in the southern part of Scotland.

As to Rates . . .

• Iowa-Nebraska Light & Power Company has appealed to the Nebraska Supreme Court from a finding of the state Railway Commission (ELECTRICAL WORLD, June 23, page 926) that that body has jurisdiction over rates and services of power companies where energy is supplied outside of incorporated municipalities. By agreement the commission will take no further action as to rural rates until the Supreme Court determines whether the law justifies the claim of implied jurisdiction.

• Duke Power Company electric and gas consumers and those of its subsidiary, the Southern Public Service Company, in North and South Carolina will find their total bill approximately $1,337,000 lower during the next twelve months as the result of new rates effective October 1. Changes were put into effect following arbitrational negotiations between the two state commissions and the companies.

• Georgia Public Service Commission, in a 40-page brief, answered the Georgia Power & Light Company's application for an injunction against a 16 to 18 per cent rate reduction. The commission took the views expressed by President Roosevelt that the Public Service Commission "is not a mere judicial body to act solely as an umpire between complaining parties, but as the agent of the people, and was created for the purpose of seeing that utilities do two things: First, give service, and, second, charge reasonable rates." The answer also stated that the Georgia Power Company and the Savannah Electric & Power Company, both of which accepted rate decreases, have shown a gradual increase in income since the reductions went into effect, whereas the Georgia Power & Light Company, which has successfully combated all efforts to reduce its rates, has shown a steadily declining revenue. The commission contends that the rates fixed for the company are fair to both the company and its patrons.

• Dallas Power & Light Company's compromise offer effecting a $400,550 annual reduction in electric rates was accepted last week by City Council. The new rate slash, effective as of August 5, adds $165,550 to the $235,000 reduction obtained two years ago. The additional reduction will be divided as follows: $62,000 to 58,881 residential consumers, $78,100 to 8,339 commercial consumers, $21,550 to 872 industrial and $3,900 to 289 government and municipal consumers. The company may retract the rate reduction after giving the city 60 days' notice and the city under the agreement also may seek a lower rate. The company was permitted to continue a special reserve not authorized by the franchise for surplus earnings. This reserve was limited by the resolution to $250,000. An important provision of the resolution was that the Dallas Power & Light Company waived any right to demand an increase in its rates of authorized return on its property value as it may under the franchise. The present rate is 9 per cent.

• Missouri Utilities Company's rate dispute at Cape Girardeau came to an end last week when City Attorney Frank A. Lowry signed a stipulation with the state Public Service Commission agreeing to dismissal of the city's and commission's mandamus suit against the company. Litigation between the company and the city started in 1927. City Attorney Lowry was direced by the council to sign the stipulation dismissing the suit following a letter from J. C. Collett, Public Service Commission chairman, that the utility had put into effect rates which were a virtual compliance with the commission's ordered reduction, to date from January 1, 1933.

• Nantucket Gas & Electric Company has been ordered by the Massachusetts Department of Public Utilities to reduce the rates on its system. In issuing the order the department ruled that the company's commercial power rate of 13 cents per kilowatt-hour shall be available to all users of electricity, with a differential in both energy rate and minimum monthly charge for seasonal customers. The board's utterance that it saw no reason why this rate should not be open to all, irrespective of the use made of the energy, appears to mark a decided development in the commission's thinking with respect to prices for different classes of service. The company has applied for a reopening of the case on the ground that the geographic and economic conditions of the property preclude drastic rate reduction.

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Chairman McNinch Predicts Further Rate Reductions

Maintaining that rates should be "based only upon actual and true value of property used and usable in the public service," Chairman Frank R. McNinch of the Federal Power Commission and a member of the National Power Policy Committee, at his home in Charlotte, N. C., for a brief visit, predicted further substantial reductions in electric rates, resulting in greatly increased use of power.

"There is enormous potential electric energy going to waste in all parts of the country," Mr. McNinch said, "and the President's program looks to the conservation of these water powers and their ultimate development to the end that electric power may be more universally available and at much lower costs to the public that at present. Power in the streams of America is an inheritance that belongs to the people, and it should be developed and distributed primarily for the social and economic advancement of the people. This does not mean that private capital should be denied a fair return on the investment. On the contrary, the further development of our power resources affords an attractive field for leadership and business ability with reasonable assurance of an opportunity to earn a fair return on money actually and economically invested."

The per capita consumption of electric energy in Canada and in certain Western states of this country, where the rates are low, is at least double the average consumption in America, Mr. McNinch stated. "Greatly increased consumption is necessary to justify radically reduced rates. But we shall never have this increased consumption until the rates are first reduced. Experience has absolutely proved this. Furthermore, if rates are to be as low as they properly should be they can be based only upon actual and true value of property used and usable in the public service."

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Corning Plant Delayed

Construction of the municipal light and power plant at Corning, Iowa, must be held up until litigation involving the plant has been reviewed by the State Supreme Court, according to a ruling by Richard F. Mitchell, chief justice of that court, who issued a stay order. The order was granted on petition of the Iowa-Nebraska Light & Power Company of Omaha (ELECTRICAL WORLD, August 11, page 190). The utility is asking the Supreme Court to reverse an Adams County district court ruling which dissolved an injunction obtained by the company to prevent erection of the plant. Justice Mitchell's order advanced the case for hearing at the court's September term. The company was required to post a $15,000 bond pending final disposition of the case.

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Appalachian Electric Adds New Unit to System

Negotiations have been practically completed by the Appalachian Electric Power Company through which it will take over the electric property and service of the West Virginia Water Service Company in the Beckley area. Lower rates under the Appalachian schedule will save consumers in the territory approximately $20,000 annually. The property being purchased by the Appalachian company will become a part of its system.

FINANCIAL · · · BUSINESS

Some Bright Spots of the Week

Middle West and Rocky Mountain States report improved conditions—Lost domestic customers regained.

Encouraging bits of news, which may be the result more of improved conditions than sales activity, come from the Middle West and Rocky Mountain states. For example, the Michigan and Ohio properties of Commonwealth & Southern Corporation report more domestic customers than ever. Domestic meters on the Michigan properties totaled 276,522 as of June 30, 1934, compared with 252,746 as of March 31, 1933. Domestic meters on the Ohio properties totaled 154,892 as of June 30, compared with 143,128 as of April 30, 1933. The increase has been stimulated by letters to customers who had been cut off during the depression due to inability to pay bills. In Michigan 241 letters sent to previous customers brought 125 customers back into the fold in one month, or a return of 52 per cent.

About 70 per cent of the domestic customers lost by the Central Illinois Electric & Gas Company have been reconnected to the lines.

Some Rocky Mountain properties of the Cities Service Company report that they expect to exceed all past peak-load and consumption records in the next few months due to increased gold and silver mining and increased activity of concentration mills. This is being caused by the high prices of these metals. Mines that have been abandoned because of low-grade ore are being opened and worked.

In Colorado the electrical energy generation in July, as in June, exceeded all previous company records of this month. Though figures for the entire company are not yet available, the energy distributed from the Central system, comprising 90 per cent of the company total, exceeded last year's figures by 15 per cent and the previous high record of the company in 1930 by 6 per cent. Such load conditions are primarily due to the unsettled hot, dry weather which brought into abnormal use fans, refrigerating and cooling equipment and exceptional use of motor-driven irrigation pumps to supplement the low irrigation in water supply and the continuation of load growth of gold mining operations.

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Associated Station Struck

Lightning struck the Possum Glory substation of the Associated Gas & Electric Company last week, causing damage estimated by Superintendent Robert T. Martin at more than $100,000. The bolt struck one of the nine 15,000-watt transformers, all of which contained from 1,400 to 1,800 gal. of oil. The ignited oil spread to the other transformers, destroying six and badly damaging three. The substation redistributed power to Clearfield, Cambria and Indiana Counties. Service was partially restored by another substation.

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Ohrstrom Utility Crash Discussed at Hearing

Although the Tri-Utilities Corporation showed assets of $47,373,818 on its books August 26, 1931, just prior to its being placed in receivership, its assets were finally sold for $4,806,181, Lewis G. Prichard, Federal Trade Commission examiner, testified before the commission this week. Mr. Prichard testified that minor adjustments of accounts of Tri-Utilities, organized in 1929 by G. L. Ohrstrom & Company, had preceded the final sale. He also stated that company officials had spent more than $350,000 in an effort to maintain market prices for the common stock and debentures.

There was no way of ascertaining from the records how much of the company's stock was sold to G. L. Ohrstrom & Company in intercompany transactions and then to the public, Mr. Prichard testified. He stated, however, that in one instance "an investment in a company controlled by Ohrstrom totaled $1,816,702, but was transferred to the books of Tri-Utilities as $9,269,751, a "write-up of $7,453,048."

MIDSUMMER LULL

Business awaits the decision of President Roosevelt on drought, NRA, labor, money and other policies. In general, it is at the midsummer lull period, with an increase in car loadings still a favorable factor. Construction continues to decline. The drought promises to make the government a dominating influence in food markets. The silver policy thus far has had no important effects.

Change in business thought and action are tied to the governmental policy for handling the crisis in relief brought about by the drought and the unemployment demands of the coming winter. In banking and security circles recovery has been had from the first shocks of the new silver policy and interest is centered on the propaganda launched for home modernization.

Energy output of utilities increased a negligible amount from levels of the previous week. Steel holds at 26 per cent of capacity, with greatest activity in tinplate. Automobile production decreases slightly. Labor unrest holds about level. Gold exports are permitted. Retail sales decrease slightly. International business picture unchanged. A fall upturn is expected by the government.

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Gross Revenue Tax Passed by Spokane Utilities

Despite vigorous protest, the Spokane City Council last week passed an ordinance levying a special 3 per cent tax on the gross revenues of the Washington Water Power Company, Home Telephone & Telegraph Company and Central Heating Company, a 1½ per cent tax on the gross revenues of the Spokane United Railways and a 1 per cent tax on the gross revenues of the Spokane Gas & Fuel Company. The new tax is to take effect October 1. It is estimated the new taxes would bring $150,000 to the city annually and it is reported a portion of it will be used to restore a 10 per cent pay cut for city employees.

Frank T. Post, president of the Washington Water Power Company, Spokane United Railways and Central Heating Company, served notice on the city commissioners that he would take the measure to the Supreme Court to determine if there is a limit to the city's powers to tax a corporation. He will also attack the ordinance on the ground of discrimination, double taxation and abuse of authority. Mr. Post said later he planned a second suit on behalf of the Spokane United Railways, in which he will allege that the proposed utility tax is a violation of the voter-approved agreement with the city in 1922 prior to the consolidation of the two street car lines operating in the city at that time.

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Laclede Utility Sued for $473,417 Taxes

Suit to collect a privilege tax of $473,417 from the Laclede Power & Light Company, a subsidiary of the Laclede Gas Light Company, was filed in Circuit Court in St. Louis last week by the city. The tax is based on 5 per cent of the gross receipts of the company, totaling $9,468,393 for a five-year period beginning in 1929. The petition filed by the city states an ordinance passed in 1917 requires any company furnishing electricity to the public to pay 5 per cent of its gross income to the city for using its

streets and alleys to place wires and cables along or across. It is stated the company was asked to furnish a statement of its receipts for the purpose of levying the tax, but that the company had refused to file a statement.

The Associate City Counselor said the Union Electric Light & Power Company, the Bell Telephone Company and other utilities operating in the city have been paying the tax since the enactment of the ordinance. The Laclede Power & Light Company contends that under its franchise it is exempt from the payment of this tax.

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Electric Public Service Plan Gets Court Approval

Holding that the plan of reorganization for the Electric Public Service Company known as the Turner plan was fair and equitable, Chancellor Wolcott in Delaware Chancery Court approved the plan recently after all parties seeking hearing had been heard. Holders of more than 89 per cent of the secured bonds of the utility have deposited their holdings under the plan.

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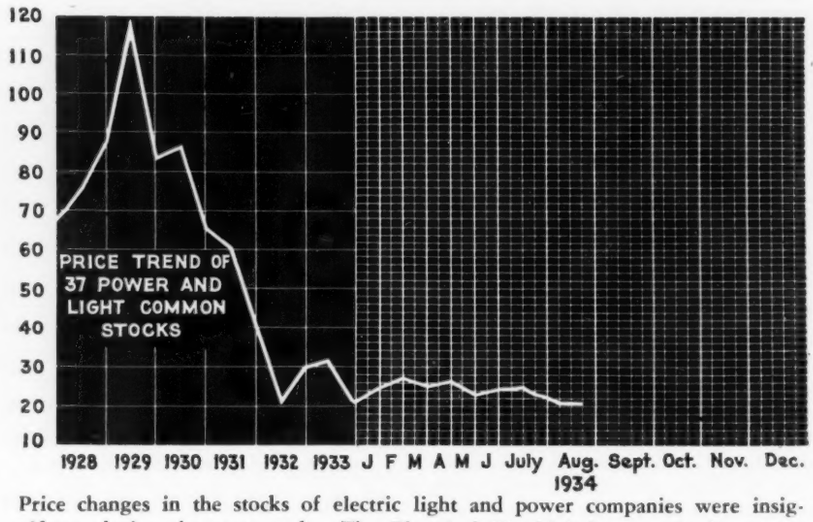
Seattle Plant Reports Increased Earnings

Operating revenues of the City Lighting Department, Seattle, Wash., for the first half of 1934 totaled $2,599,006, according to a report made to the City Council by Lighting Superintendent J. D. Ross. This is a gain of $48,746 over the corresponding six months of last year. Operating expenses for the period were reduced to $1,464,423 from $1,496,522. This cut in operating expenses helped to bring the net income of the property up to $247,931, an increase of $140,137 over the first six months of last year. Mr. Ross reported gains this year in power production, commercial power sales and electrical appliance sales.

Utility Stocks Unchanged



Price changes in the stocks of electric light and power companies were insignificant during the past week. The *Electrical World* index remained at 20.9.

Complete Air Conditioning for Rockefeller Center

One of the most thoroughly air-conditioned buildings to have been constructed thus far, La Maison Francaise, in Rockefeller Center, New York City, offers five atmospheric controls. Temperature, humidity, purification (removal of odors, dust and ionizing of air), controlled circulation (to eliminate

Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1934	1933	Per Cent Increase	Operating Ratio 1934	Operating Ratio 1933
Alabama Power (Year to June 30)					
Gross earnings	$15,608,975	$15,240,647	2.4	51	48
Net earnings	7,674,068	7,852,691	— 2.3		
Net balance	619,748	863,125	—28.2		
Consumers Power (Year to June 30)					
Gross earnings	27,531,655	26,171,318	5.2	55	54
Net earnings	12,089,474	11,943,729	1.2		
Net balance	3,259,094	3,142,842	3.7		
Georgia Power (Year to June 30)					
Gross earnings	22,264,290	21,877,489	1.8	53	48
Net earnings	10,558,645	11,420,101	— 7.6		
Net balance	1,491,168	2,299,691	—35.2		
Kansas City Power & Light (Year ended June 30)					
Gross earnings	14,481,496	14,393,590	0.6	64	63
Net earnings	5,173,481	5,387,234	— 3.9		
Net balance*	3,277,307	3,514,691	— 6.7		
Ohio Edison (Year to June 30)					
Gross earnings	15,578,464	14,516,236	7.3	51	49
Net earnings	7,624,488	7,446,984	2.4		
Net balance	1,876,005	1,717,335	9.2		
Pennsylvania Power & Light (Year ended June 30)					
Gross earnings	33,664,062	32,568,687	3.4	55	53
Net earnings	15,092,172	15,401,632	— 2.0		
Net balance	5,453,847	5,796,765	— 5.9		
Southern California Edison (Year ended June 30)					
Gross earnings	35,787,855	35,523,930	0.6	50	45
Net earnings	17,934,927	19,453,287	— 7.8		
Net balance*	10,606,194	12,162,950	—12.8		
Tennessee Electric Power (Year ended June 30)					
Gross earnings	12,079,424	11,201,634	7.8	61	58
Net earnings	4,681,428	4,738,644	— 1.2		
Net balance	490,772	523,536	— 6.2		

Holding Companies

	1934	1933	Per Cent Increase	Operating Ratio 1934	Operating Ratio 1933
American Water Works & Electric and subs. (Year ended June 30)					
Gross earnings	$44,973,586	$41,508,977	8.3	57	55
Net balance	2,407,140	1,821,732	32.1		
Buffalo, Niagara & Eastern Power and subs. (Year ended June 30)					
Gross earnings	30,447,755	28,627,979	6.3		
Net balance	8,398,342	6,994,038	20.2		
Commonwealth & Southern and subsidiaries (Year ended June 30)					
Gross earnings	113,520,152	108,674,023	4.5	57	55
Net balance	126,826	275,335	—53.9		
Mohawk Hudson Power and subsidiaries (Year ended June 30)					
Gross earnings	36,751,137	34,245,627	7.3		
Net balance	4,032,879	5,655,667	—28.6		
Niagara Hudson Power and subsidiaries (Year ended June 30)					
Gross earnings	72,215,047	68,614,606	5.2		
Net balance	6,607,159	5,917,260	11.6		
North American and subsidiaries (Year ended June 30)					
Gross earnings	106,884,595	107,587,591	— 0.7	68	67
Net balance	8,893,015	11,199,902	—20.7		
United Gas Improvement and subsidiaries (Year ended June 30)					
Gross earnings	84,522,390	109,226,895	—22.7	55	55
Net balance	28,431,841	29,763,442	— 4.5		

*Available for all dividends.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings—Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net balance—Balance available from income for common stock dividends.

dead-spots and drafts) and noise immunization and elimination are the controls employed. La Maison Francaise will have a total conditioned area of 85,000 sq.ft. representing a volume of more than 1,100,000 cu.ft.

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All-Welded Ship Launched

The largest all-welded vessel in the American merchant marine was launched last week when the motor tanker *Poughkeepsie-Socony* went down the ways at the Staten Island plant of the United Dry Docks, Inc. In the construction of the ship 105,000 ft. of electric welding serves the purpose of approximately 250,000 steel rivets. The ship's power plant consists of two Diesel engines of the air-injection type, aggregating 750 brake-hp. and driving twin screws.

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Graybar to Distribute Hurley Machine Products

Distribution arrangements have been completed between the Hurley Machine Company of Chicago and the Graybar Electric Company involving practically nation-wide handling of Hurley household washer and ironer lines, according to announcement by President Edward N. Hurley, Jr. The Hurley company's Thor washers and ironers will be distributed by Graybar in Texas, parts of Spokane and Tacoma, Wash., ten counties of New York, and Florida, Tennessee, Georgia, Mississippi and Alabama. Graybar will handle the new Meadows line of the Hurley company in practically all other sections.

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Public Service Electric Gets Railroad Contract

Under the terms of a contract just signed with the New York Central Railroad Company, the Public Service Electric & Gas Company will supply the full electric power requirements at the large terminal of the West Shore Railroad in Weehawken. The terminal is now supplied with electricity by the railroad company's own generating station, which will be dismantled as soon as Public Service current can be made available.

New York Metal Prices

	Aug. 7, 1934 Cents per Pound	Aug. 14, 1934 Cents per Pound
Copper, electrolytic	9.00*	9.00*
Lead, Am. S. & R. Price	3.75	3.75
Antimony	8.25	8.75
Nickel ingot	35.00	35.00
Zinc, spot	4.65	4.65
Tin, Straits	51.75	52.90
Aluminum, 99 per cent	23.30	23.30

*Blue Eagle.

SALES OPPORTUNITIES IN NEW CONSTRUCTION

Spot coverage of the week. Projects approved and proposed, bids requested, equipment wanted, funds available. Prospects for the electrical manufacturer.

Durand, Wis. — Wisconsin Hydro-Electric Company plans extensions and improvements in transmission lines, including reinforcing of 22,000-volt system between Clayton and Clear Lake with new poles, line hardware, etc.; work has begun on new 6,600-volt transmission line from Huntington to Star Prairie, Wis. Improvements have been authorized in hydro-electric generating plant at Eau Galle, Wis., and improvement program will be carried out in steam department at station at Colfax, Wis.

Hannibal, Mo. — Asks bids until August 27 for one 9,375-kva. turbo-generator unit, one surface-type condenser and complete accessory equipment for city-owned electric light and power plant. Baumes-McDevitt Company, Inc., Railway Exchange Building, St. Louis, Mo., is consulting engineer.

Chicago, Ill.—Container Corporation of America, Inc., will make extensions and improvements in corrugated container and paper box manufacturing plants in different parts of country during next nine months to cost about $831,000, with equipment installations.

Denver, Colo. — Bureau of Reclamation asks bids until August 27 for three 16x17-ft. radial gates, three motor-driven double-drum gate hoists, four high-pressure gates with hydraulic hoists, gate hangers, automatic air valves, conduit linings, two plate steel outlet pipes, etc., for spillway and outlet works, Hyrum Dam, Utah (Specification 586).

Sacramento, Calif.—Sacramento Irrigation District, Albert Given, chief engineer, is having surveys and report made for proposed public-owned electric light and power plant, transmission and distribution lines in Sacramento Valley district. Cost over $10,000,000. Burns & McDonnell Engineering Company, 107 West Linwood Boulevard, Kansas City, Mo., consulting engineer.

Baltimore, Md. — Chevrolet Motor Company, Detroit, Mich., plans installation of motors and controls, transformers and accessories, conveyors, hoists and other equipment in new multi-unit assembling works in Canton industrial district, section of plant to be used by Fisher Body Company, affiliated organization. Cost about $400,000. Albert Kahn, Inc., New Center Building, Detroit, architect and engineer.

West Point, Va. — Albemarle-Chesapeake Company, Inc., and Chesapeake Corporation, affiliated interests, manufacturers of kraft papers, boards, etc., plan installation of motors and controls, conveyors, hoists, loaders, etc., for expansion and improvements at mills. Cost about $300,000.

San Francisco, Calif. — Procurement Division, Veterans' Administration, Washington, D. C., asks bids until August 23 for one motor-generator set for institution at San Francisco (Proposal X-15).

Colorado Springs, Colo.—Is planning new transmission line in North Cheyenne Canon district, with power service to be furnished by city-owned electric light and power plant.

Fairfax, Minn.—Has authorized new city-owned electric light and power plant and electric distribution system, at special election, and plans will be completed at once. Diesel engine-generator units are proposed.

Washington, D. C. — Pennsylvania Railroad Company, Philadelphia, Pa., has taken out a permit for new power substation on South Capital Street and power switching station on K Street, N.E., to be used in connection with electrification of lines between Baltimore and Washington.

Cleveland, Ohio — Industrial Rayon Corporation plans installation of motors and controls, conveyors and other equipment in proposed addition to local mill. Cost over $1,000,000. Christian, Schwarzenburg & Gaede, 1836 Euclid Avenue, architects.

Washington, D. C.—General Purchasing Officer, Panama Canal, asks bids until August 30 for motor-driven pumping machinery, including complete control equipment, switchboard, etc. (Schedule 2987.)

Norfolk, Neb.—Plans city-owned electric distribution system and will have estimates of cost made by Black & Veatch, Mutual Building, Kansas City, Mo., consulting engineers.

San Diego, Calif. — Plans new city-owned electric light and power plant, using Diesel engine-generator units, for service for downtown street-lighting system and harbor district requirements. Cost about $150,000.

Langley Field, Va. — National Advisory Committee for Aeronautics asks bids until September 5 for complete electrical equipment for driving machinery for operation of high-speed wind tunnel, including 1,000/8,000-hp. wound-rotor induction motor unit, with slip regulator control, fixed static condenser and all auxiliary motor units, switching apparatus, meters, connection equipment in conjunction with existing power substation, etc.

Cincinnati, Ohio — Limestone-Linestone Distillery, Inc., recently organized, care of Howard W. Ragland, 603 St. Paul Building, plans new distilling plant on site near city. Cost over $100,000 with equipment.

Perry, Mo.—Is arranging bond issue of $50,000 of total amount of $63,600 to be used for new city-owned electric light and power plant, using Diesel engine-generating unit. Bids will be asked soon. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are consulting engineers.

Seattle, Wash. — Superintendent of Municipal Lighting asks bids until August 23 for transmission line insulators, line hardware, fittings, etc., and for high-tension bus equipment for Diablo hydro-electric power project. (Bids received July 12 rejected.)

MEN OF THE INDUSTRY

BANCROFT GHERARDI, vice-president and chief engineer of the American Telephone & Telegraph Company, New York, has been appointed a representative of the American Institute of Electrical Engineers on the John Fritz Medal board of award, to succeed the late W. S. Lee.

GEORGE J. LYNCH, formerly identified with the Eau Claire office of the Northern States Power Company, has been appointed manager of the company at Mankato, Minn. A. G. BUCHHOLZ, manager at Mankato, has been transferred to Sioux Falls, S. D., as manager, to succeed O. A. Rofelty.

STEPHEN CROOM of Mobile was appointed last week by the Alabama Public Service Commission assistant engineer for the commission, to succeed Arthur M. Dunstan, who resigned some time ago to accept a position with the Federal Power Commission.

C. C. DRISCOLL, formerly in the frequency change department of the Consumers Power Company, Grand Rapids, Mich., left recently to return to his home in Australia, where he will be associated with K. H. Milne as an engineer with the Adelaide Electric Supply Company, Adelaide, Australia.

C. J. GALLOWAY has been appointed to the commercial department of the Washington Water Power Company, in charge of merchandise promotion. Mr. Galloway has been engaged in merchandising in Spokane stores for more than twenty years. He will devote his entire time to working with dealers of electrical appliances throughout the territory served.

ALLEN S. KING, manager of the Northern States Power Company at Minot, N. D., has been transferred to Grand Forks, as manager of the Red River Power Company. In this position he succeeds P. J. MONTGOMERY, who was transferred to Fargo as assistant to John McGuire, manager of the Union Light, Heat & Power Company there. JOHN S. HOGAN, manager of lighting sales in Minneapolis, was appointed manager of the company at Minot, to succeed Mr. King.

JAMES L. FLY has resigned as special assistant to the Attorney-General to become general solicitor of the Tennessee Valley Authority. A graduate of the United States Naval Academy, Mr. Fly resigned his commission after three years of service to pursue his law studies, completing his Harvard Law School course in 1926. Private practice with White & Chase in New York City led to his appointment in 1929 as special assistant to the Attorney-General. During the ensuing years he has acted as counsel for the government in a number of important cases arising under the anti-trust laws and related statutes.

CHARLES WEBSTER, a member of the Iowa Railroad Commission, will retire to private life upon the expiration of his term next December after seventeen years of public service. First elected in 1917 and standing successfully for reelection each four years thereafter, Mr. Webster is one of the oldest state commissioners in point of service in the country. For many years he was prominently identified with the work of the National Association of Railroad and Utilities Commissioners and was elected to the presidency in 1929. After he retires Mr. Webster intends to devote himself to his numerous business interests.

C. M. DAVIS, formerly assistant engineer of the transportation department of the General Electric Company, Erie, Pa., has been appointed engineer in charge of that department. A native of Chicago and a graduate of the University of Michigan, Mr. Davis entered the test department of the General Electric Company at Schenectady, N. Y., in 1909. Following a period of time spent in the consulting engineering department under Dr. C. P. Steinmetz he entered the railway engineering department in 1913, and became assistant engineer in 1930, the department meanwhile having been moved to Erie. In 1924 he was sent to Australia in connection with the South Wales government railway electrification.

ERNESTO MERCIER, president of the Société de Constructions Mecaniques et Electriques, Paris, has recently been elected president of the International Conference of Large Electricity Distribution Undertakings, to succeed the late Mr. Ulrich.

MAJOR EDWIN H. ARMSTRONG, well known in the radio communication field, has been appointed professor of electrical engineering at Columbia University, New York. Major Armstrong will direct instruction in radio communication and high-frequency research in the Hartley laboratories, the scene of Prof. Michael I. Pupin's triumphs in electrical transmission and of his own early efforts in the development of the vacuum-tube oscillator, which revolutionized radio. The appointment of Major Armstrong fills the professorial vacancy created last winter by the death of Prof. J. H. Morecroft. Since 1913 Major Armstrong has obtained about twenty-five patents allied with the radio field, most of which are in practical use.

OBITUARY

RALPH ROBERTS LAXTON, sales engineer with the Westinghouse Electric & Manufacturing Company at Charlotte, N. C., died recently, in his sixty-fifth year. Following varied experience in railroad and power plant work he became assistant to the local manager of the General Electric Company in Atlanta, Ga., in 1903, and after a short period of supervisory work joined the Westinghouse organization in 1906, working in Atlanta and Charlotte offices.

WILLIAM M. SCOTT, division superintendent of the Utah Power & Light Company, Salt Lake City, died recently. A native of Indiana, Mr. Scott moved at an early age to Utah and became identified with the Union Power & Light Company in 1897. Six years later he was made construction superintendent of lines and, gradually assuming additional responsibilities, became superintendent of the Salt Lake division of the Utah Power & Light Company about 1914. In this position he was in charge of substations, electrical service and line construction. Mr. Scott was 70 years of age.

J. R. COOKE, formerly chairman of the Ontario Hydro-Electric Power Commission, died at his home in Belleville, Ont., August 13 from injuries suffered in an automobile accident. Mr. Cooke had been minister without portfolio in the Ontario government when he was appointed some thirteen years ago by the Legislature on the committee that studied the distribution of energy to the rural parts of the province. Before assuming the chairmanship of the commission in 1931 Mr. Cooke served as a member of that body under the late Sir Adam Beck and later under C. A. Magrath.

WILLIAM MAHANNA, one of the founders of the Lenox (Mass.) Electric Light Company, and for many years prominent in western Massachusetts banking and construction fields, died at his home in Lenox August 10, at the age of 82.

JAMES MILNE, electrical and mechanical engineer for the city of Toronto, Ont., died recently, in his seventieth year. A native of Scotland, he served an apprenticeship as a mechanical engineer following the completion of his technical education. In 1887 he went to Canada, where he was employed by the Edison General Electric Company in Montreal. For six years following 1890

he was general superintendent of the Toronto Electric Light Company, and subsequently became general manager and chief engineer of the Underfeed Stoker Company, Toronto, and also engaged in consulting engineering. In 1906 he was appointed general superintendent of the British Columbia Electric Railway Company, Vancouver, B. C., which he left in 1910 to engage in consulting engineering in Vancouver, Windsor and Toronto. He assumed his duties as engineer for the city of Toronto in 1914 and was so engaged until his death. Mr. Milne was a member of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers.

EDWARD D. MATHEY, engineer of New York, died recently, after a prolonged illness. After graduation from the Stevens Institute of Technology in 1894 his first work was as draftsman for street railway companies, designing the west side substations for the Manhattan Elevated Railway Company, New York, in 1901. In 1902 he joined Westinghouse, Church, Kerr & Company, New York, where he remained until 1917, directing the electrical design work of the Pennsylvania Railroad power station in Long Island City and of substations of the Long Island Railroad. He was also engineer of electrical work for several power installations. In 1917 he became electrical engineer in charge of the electrical division of Air Nitrates Corporation, agent for the United States government for the design, construction and operation of plants for nitrate production. He continued the same type of work after the war, joining the American Cyanamid Company, New York.

FREDERICK G. PROUTT, consulting engineer and chairman of the City Board of Water Commissioners of Memphis, Tenn., died recently, after an illness of six months. A native of Bowmanville, Ont., Canada, Mr. Proutt obtained his early experience with the Canadian Bell Telephone Company, the Bowmanville Electric Light Company and the General Electric Company's student course at Lynn, Mass. Upon completion of the course, in 1894, he became chief electrician of the Malden (Mass.) Electric Company and three years later joined the Memphis Light & Power Company at Memphis, Tenn., in the same capacity, where he was responsible for rebuilding the plant. After a two years' connection with the electrical properties at Jackson, Miss., he returned to Memphis, where he opened his office as a consulting engineer. He worked as a consultant for many utilities and since 1920 had been chairman of the Board of Water Commissioners. Mr. Proutt was a member of the American Institute of Electrical Engineers and of the American Society of Mechanical Engineers.

NEW EQUIPMENT

Time Switch in Meter Case

"Meter" type time switches, so termed because they are mounted in Westinghouse Type CS outdoor meter cases and especially designed for off peak water heating service, are announced in two series by Paragon Electric Company, Old Colony Bldg., Chicago, Ill. In the

Paragon Electric Co.

synchronous series the time unit is the "Synchron" motor with its internal gear reduction sealed in a dust-tight die casting containing perpetual lubrication for the life of the motor. The self-winding series uses a precision clock movement containing a heavy jeweled escapement equipped with a temperature compensating hairspring. Switches are phosphor bronze and molded bakelite with heavy pure silver contacts. A positive snap action is provided for both "make" and "break."

Standard types are furnished with standard Westinghouse glass cover and Type S armor-mounting parts, but do not include meter socket, which, however, can be supplied if required. Thermostats and heat coils can also be furnished mounted within the assembly and are recommended for outdoor installations where the temperature drops below zero degrees.

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New Air Conditioner

The William C. Carr Corporation, Richmond, Va., and 25 Huntington Avenue, Boston, Mass., is introducing a new air-conditioning unit of the console type, consuming only 60 watts and designed to filter, wash, humidify and circulate air with an operating cost of only 5 or 6 cents per fifteen-hour day. The unit is capable of serving four ordinary-sized rooms and uses a mineral wool filter, 12-in. fan operating at 850 r.p.m. and a wet scrubbing principle by which eliminating plates not only wash the air but remove objectionable odors as well. A 5-gal. copper tank is provided for water storage, and this may be filled by hand or by piping to a supply system as desired. The unit weighs but 80 lb. empty of water and has an output of 8 gal. per day at 72 deg. F. and 20 per cent relative humidity. It handles about 20,000 cu.ft. of air per hour and its over-all dimensions are only 33x17x18 in.

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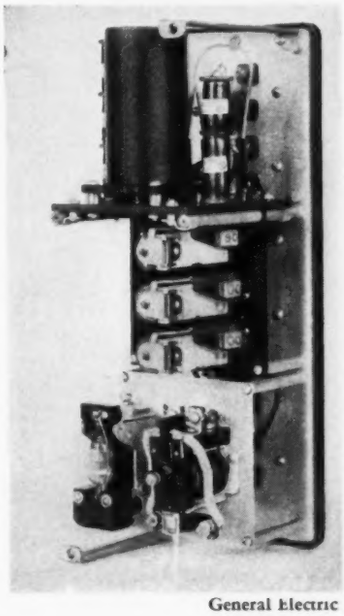
Automatic Relay for Synchronizing

A synchronizing relay featuring automatic compensation for errors due to source voltage difference and control-voltage variations is announced by General Electric Company, Switchgear Division, Philadelphia, Pa. An advance transformer operates through a pair of thermionic (electron) tubes to control auxiliary relays so that the breaker closure is initiated with the proper advance time, according to the operating time of the breaker, to effect closing of the breaker near the exact instant of true synchronism (zero phase displacement). The relay may be used for either machine synchronizing or line synchronizing, in either automatic or manual stations. All tubes and the few moving parts are mounted in a 5½ by 16-inch universal case with an auxiliary



General Electric

box 9½ by 17 inches mounted on the relay studs behind the panel.

Advantages of the new relay include the following: freedom from material errors due to voltage differences; quick and accurate synchronizing, even if the frequency variations are erratic; constancy of advanced time, even for varying frequency differences; reliability of performance; low energy consumption; compact arrangement.

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Solenoid-Operated Oil Circuit Breakers

Solenoid-operated oil circuit breakers of a new type have been placed on the market by the Roller-Smith Company,

Rectifiers to supply d.c. to closing coil
Auxiliary switch
Mounting on pipe or flat surface
D.c. closing coil
Terminal block with cover
Breaker unit
Holding coil a.c. or d.c.
Roller-Smith

New York. Solenoid and breaker are bolted together to eliminate all field adjustment and permit mounting as a unit. Rectifiers are used with the d.c. coils for a.c. operation, thus eliminating the use of a.c. magnets and motors for closing. They are adapted for remote control of 2,300- and 4,000-volt circuits and as the main control breaker on the starting panels of synchronous and induction motors, for which service they are equipped with holding coils for push-button control.

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Trumbull Electric Manufacturing Co.

SOLDERLESS LUGS called "Handi-lugs" and available from No. 14 to 1,000,000 circ. mil in eight sizes, each of which takes several wire sizes, have been put out as a new line by the Trumbull Electric Manufacturing Company, Plainville, Conn.

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Air Conditioner by Chrysler

Temperature Corporation, New York, will be the distributors of the new air conditioner announced by Amplex Division of Chrysler Motors. Fans of 600 c.f.m. capacity circulate air to the water spray and thence to the heating or cooling coils of 240 square feet radiation. The cooling capacity is equivalent to one ton when circulating 50° F. water at 30 pounds per minute. Spray takes 1½ pounds per minute. The motor driving the two fans is ⅛ horse power.

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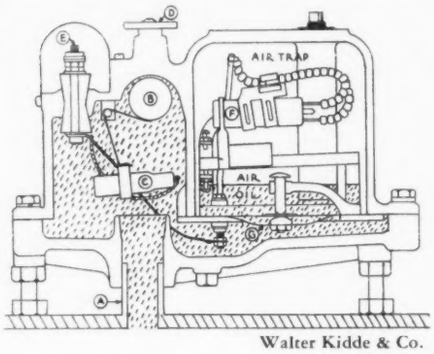
Transformer Protector Works on Gas Pressure

The Kidde Transformer Protector of Walter Kidde & Co., Inc., of Bloomfield, N. J., is a newly announced device combining prevention and protection for transformers. It gives a premonitory bell warning of incipient failures and will also disconnect transformer when a serious internal fault occurs. Functioning on the Buchholz principle of entrapped gas and response to a gas pressure wave, in Europe the scheme has been applied to 600 million kva of transformer capacity.

The alarm apparatus involves a mercury switch operated by a float placed in oil above which gases from decomposition of oil or insulation are visibly trapped. A diaphragm sensitive to pressure waves operates another mercury switch to trip the circuit breaker on severe internal faults. This disconnect element resets but will trip again if the fault is restored when the breaker is closed. It is claimed that the protector costs from one-fifth to one-half as much as differential relay protection.



Walter Kidde & Co.

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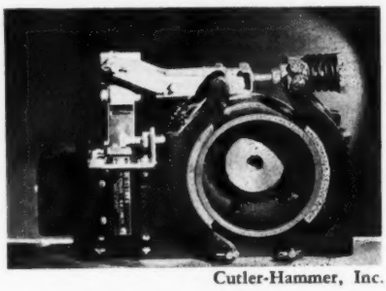
Small Electric Brakes for Quick Stops

Cutler-Hammer, Inc., Milwaukee Wis., announces a new line of small a.c. and d.c. solenoid operated brakes. Three new brake sizes are included with torque ratings ranging from 3 pounds-feet to 75 pounds-feet. The brake wheel is relatively large, allowing low total brake shoe pressures, which results in low unit pressure on the lining and therefore long, even wear of the friction surfaces. Low shoe pressure results in low stresses and longer wear, and allows the use of a small operating solenoid. Dimensions of the a.c. and d.c. brakes are interchangeable. Brake shoes


Cutler-Hammer, Inc.

use moulded brake lining and provide 180° braking service.

These new brakes are intended for applications on machine tools, conveyors, small hoists, dumb waiters, overhead door hoisting equipment, small elevators, printing presses, laundry equipment, and similar small machines where quick, sure stops are required.

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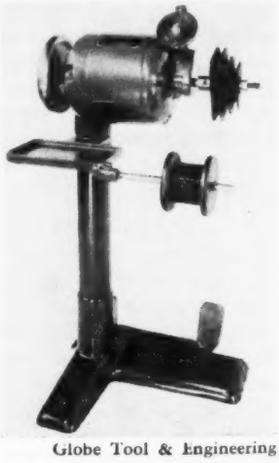
Coil Winder With Foot-Pedal Speed Control

A new coil winder which winds various types of motor coils, also electromagnetic and radio coils, has been announced by the Globe Tool & Engineering Company, Dayton, Ohio. It has foot-pedal speed control, also a motor shaft extension on which winding forms of any design may be mounted, will wind armatures up to 1 hp. and is especially adapted for winding banks of insertion coils for armatures or fields where basket or lap winding is used. Additional foot pressure on the pedal increases machine speed to maximum 4,000 r.p.m. When the proper number


Globe Tool & Engineering

of turns have been obtained at convenient selected speed the operator removes foot from the pedal and an incorporated brake is immediately applied as the current is shut off.